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***Via Electronic Mail and Hand Delivery***

Jeanine Townsend, Clerk to the Board
State Water Resources Control Board
1001 I Street, 24th Floor
Sacramento, CA 95814
commentletters@waterboards.ca.gov

Re: Sacramento Valley Water Users' Comment Letter – Bay-Delta Plan Supplemental Notice of Preparation – Comprehensive Review

Dear Ms. Townsend:

These comments are submitted on behalf of the parties listed on Exhibit 1 attached hereto, and collectively referred to herein as the Sacramento Valley Water Users or SVWU. The SVWU appreciate this opportunity to provide these comments pursuant to the State Water Resources Control Board's (SWRCB) January 24, 2012 Supplemental Notice of Preparation (NOP) and Notice of Scoping Meeting for the Update and Implementation of the Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (Bay-Delta Plan): Comprehensive Review.

A. *General Background*

The NOP explains that the "Bay-Delta Plan identifies beneficial uses of the Bay-Delta, water quality objectives for the *reasonable protection* of those beneficial uses, and a program of implementation for achieving the water quality objectives." (NOP at p. 2, emphasis added.) One of the purposes of the NOP is to "seek input on significant environmental issues, reasonable alternatives, and mitigation measures that should be addressed in the SED [Substitute Environmental Document] . . . ." (*Id*. at p. 4.) The NOP includes a Project Description, which states as follows:

> The proposed Project includes review of potential modifications to current objectives included in the 2006 Bay-Delta Plan, the potential establishment of new objectives, and modifications to the program of implementation for those objectives. The proposed project also includes potential changes to the monitoring and special studies program included in the 2006 Bay-Delta Plan. *The*

> *proposed Project does not include amendments to water rights and other measures to implement a revised Bay-Delta Plan. A separate Environmental Impact Report will be prepared for these actions.* As noted above, a separate SED is being prepared to address updates to the water quality objectives for the protection of southern Delta agricultural beneficial uses; San Joaquin River flow objectives for the protection of fish and wildlife beneficial uses; and the program of implementation for those objectives. (*Id.* at p. 6, emphasis added.)

According to the SWRCB, its issuance of the NOP "starts the process of soliciting information to inform the next phase of the State Water Board's comprehensive Bay-Delta Plan update." (See SWRCB's January 27, 2012 Fact Sheet.) The SVWU submit these comments based upon this characterization of the process by the SWRCB.

B. *Summary of Key Comments*

As a fundamental premise, the SWRCB's development of any new water quality objectives for its Bay-Delta Plan update must be reasonable. As detailed below, implementing water quality objectives for Delta outflow and Sacramento River inflows based on 40% or 50% of unimpaired flows would be unreasonable because implementing such objectives would cause severe hydrologic, environmental and water supply impacts. If the SWRCB were to propose new Bay-Delta water quality objectives based upon such percentages of unimpaired flows, then the California Environmental Quality Act (CEQA) would require the SWRCB to analyze many significant environmental impacts that would occur in numerous resource categories. Moreover, state-of-the-art streamflow requirements already govern the major rivers in the Sacramento Valley. Because these streamflow requirements have been developed largely to integrate fishery protection and water supplies, CEQA would require the SWRCB to at least analyze a reasonable alternative of establishing any new water quality objectives concerning Bay-Delta streamflows based upon the Delta inflows produced by existing streamflow requirements for the Sacramento Valley's rivers.

C. *California Environmental Quality Act Compliance Issues*

1. *Environmental Review of the Proposed Bay-Delta Plan Update Is Premature Because the SWRCB Has Not Adequately Defined the Project*

CEQA requires that an NOP include a description of the project that will be the subject of environmental review, as well as a summary of the probable environmental effects of the project. (CEQA Guidelines, § 15082 subds. (a)(1)(A),(C).) The purpose of soliciting comments on an NOP is to receive input regarding the significant environmental issues, alternatives, mitigation measures and range of actions that need to be explored in the environmental document, and to bring together and resolve the concerns of affected federal, state, and local agencies. (CEQA Guidelines, § 15083 subd. (a).) In order for the public to provide meaningful comments on the scope of the environmental document, the project description must provide an adequate explanation of what the project is intended to do, and what changes the public can expect as a result of adopting the project. An "accurate, stable and finite project description is the sine qua non of an informative and legally sufficient EIR." (*San Joaquin Raptor/Wildlife Rescue Center v. County of Stanislaus* (1994) 27 Cal.App.4th 713, 730.)

Contrary to this requirement, the proposed project has not been fully or clearly defined in the NOP. For example, the NOP states:

> Specifically, the State Water Board seeks input and information to support whether the water quality objectives and associated program of implementation discussed above should be modified or whether they should remain the same. In particular, the State Water Board seeks input and information to support whether Delta outflows, Delta inflows, and water project operational constraints should be increased, decreased, or remain the same. (NOP at p. 4.)

The NOP also states,

> In addition to the issues identified in the 2009 Staff Report, the State Water Board will also consider other potential changes to the Bay-Delta Plan that were not specifically addressed in the report, including issues that are identified through the scoping process. The State Water Board may also consider information that is produced as part of the Bay Delta Conservation Plan (BDCP) currently being developed. (*Id*. at p. 3.)

It is unclear, however, what specific information from the BDCP the SWRCB intends to consider regarding potential changes to the Bay-Delta Plan. It appears the SWRCB is using the NOP, as well as the ongoing BDCP process, to develop the project description for its update to the Bay-Delta Plan. Without complete and accurate information about the project now, it is very difficult for the public to provide meaningful and complete comments about the range of issues that must be evaluated, especially alternatives and mitigation measures. As a result, it is premature for the SWRCB to request comments on the scope and content of an environmental document for the Bay-Delta Plan update. After the project is adequately defined and described, the SWRCB should issue a new NOP. The SWRCB should, therefore, treat the current NOP as only the first step towards developing a project description that will be circulated to the public by means of a second – and legally adequate – NOP that will properly commence the CEQA process.

2. *The SWRCB's Approach to Updating the Plan and Associated Environmental Review Improperly Segments the Analysis of Environmental Effects*

On February 13, 2009 the SWRCB issued its initial, underlying NOP for this proceeding to update the Bay-Delta Plan. In the February 13, 2009 notice, the SWRCB stated that it would stage components of its environmental review of the Bay-Delta Plan, and the environmental review for potential changes to water rights and other measures needed to implement any revisions to the Bay-Delta Plan, by preparing more than one environmental document. That earlier NOP indicated the work could be completed in four stages:

1. Bay-Delta Plan review and update of the San Joaquin River flow and southern Delta salinity objectives and their program of implementation;

2. Amendment of water rights and other measures to implement the San Joaquin River flow and southern Delta salinity objectives;

3. Review and update of other components of the Bay-Delta Plan and their program of implementation;

4. Amendment of water rights and other measures to implement other components of the Bay-Delta Plan.

The February 2009 notice stated that the proposed Project would include both: 1) the review and update of water quality objectives, including flow objectives, and the program of implementation in the Bay-Delta Plan; and 2) changes to water rights and water quality regulation consistent with the program of implementation. However, at that time, the SWRCB only requested comments from responsible and trustee agencies and interested persons concerning the scope and content of the environmental information to be included in the environmental evaluation of the documentation relating to the southern Delta salinity and San Joaquin River flow objectives and their implementation. A separate environmental document is being prepared for that element of the Bay-Delta Plan update. Now, the latest supplemental NOP states that the SWRCB will defer consideration of changes to water rights and other unidentified measures necessary to implement the project.[1] This piecemeal approach to environmental review of the Bay-Delta Plan update is flawed, and precludes meaningful analysis or consideration of the potential range of environmental effects associated with the Plan.

CEQA defines "project" as "the whole of an action, which has a potential for resulting in a physical change in the environment . . . ." (CEQA Guidelines, § 15378 subd. (a).) CEQA does not permit an agency to conceal potential environmental impacts by focusing separately on isolated parts of an overall action. (*Ibid*.; *City of Sacramento v. State Water Resources Control Bd*. (1992) 2 Cal.App.4th 960, 969 [water board's consideration of rice pesticide plan must address environmental effects of steps required to implement plan]; *Bozung v. Local Agency Formation Comm'n* (1975) 13 Cal.3d 263, 283.) Here, the project is the entire process required to develop and implement flow criteria, including changes to water rights identified in the NOP. (*City of Sacramento v. State Water Resources Control Bd*, *supra*; see also *City of Arcadia v. State Water Resources Control Bd*. (2006) 135 Cal.App.4th 1392, 1395-1396 [rejecting water board's functional equivalent document for water quality regulatory plan for failure to consider reasonably foreseeable environmental effects of actions required to implement plan].)

[1] The NOP states: "The proposed Project includes review of potential modifications to current objectives included in the 2006 Bay-Delta Plan, the potential establishment of new objectives, and modifications to the program of implementation for those objectives. The proposed project also includes potential changes to the monitoring and special studies program included in the 2006 Bay-Delta Plan. *The proposed Project does not include amendments to water rights and other measures to implement a revised Bay-Delta Plan*." (NOP at p. 6, emphasis added.)

The decision to segregate environmental review of the various elements of the Plan violates CEQA's mandate that an EIR evaluate the whole of an action that is likely to have environmental effects, including action that is a reasonably foreseeable consequence of the initial project, if the subsequent phases of the project or other action will change the scope or nature of the project's environmental effects. (*Laurel Heights Improvement Assn v. Regents of Univ. of Cal.* (1988) 47 Cal.3d 376, 396.) Here, the NOP describes several processes to update the Plan, each of which tackles part of the Plan update, and improperly proposes to conduct separate environmental review of the various elements of the Plan.

One of CEQA's basic purposes is to inform government decision-makers and the public about the potential significant environmental effects of proposed projects. (CEQA Guidelines, § 15002(A)(1); *Citizens of Goleta Valley v. Board of Supervisors* (1990) 532 Cal.3d 553; *Laurel Heights Improvement Assn v. Regents of Univ. of Cal.*, *supra*.) "[A] paramount consideration is the right of the public to be informed in such a way that it can intelligently weigh the environmental consequences of any contemplated action and have an appropriate voice in the formulation of any decision." (*Environmental Planning and Information Center v. County of El Dorado* (1982) 131 CalApp.3d 350, 354.) Without a clear description of the range of activities that are reasonably foreseeable and necessary to implement the Plan update, it is impossible to adequately assess the range of potential environmental effects. Accordingly, the SWRCB's proposed phased environmental review for its Bay-Delta Plan update would not comply with CEQA.

D. *The SWRCB's Development of Water Quality Objectives Must Be Reasonable*

Protection of water quality in California is governed by the Porter-Cologne Water Quality Control Act, Water Code section 13000 et seq. (Porter-Cologne). A fundamental premise of Porter-Cologne is that water quality regulation must be reasonable. (See, e.g., Wat. Code, § 13000.) The SWRCB is empowered to adopt Water Quality Control Plans (also known as Basin Plans), which must include: beneficial uses of the waterbodies in the region; water quality objectives (WQOs) to reasonably protect the beneficial uses; and a program of implementation for the WQOs. (Wat. Code, §§ 13050(h), (j), 13170, 13241, 13242.) In formulating a water quality control plan, the SWRCB seeks "to attain the highest water quality which is *reasonable*, considering all demands being made and to be made on waters of the state and the values involved." (Wat. Code, § 13000, emphasis added.)

WQOs are defined as, "the limits or levels of water quality constituents or characteristics which are established for the *reasonable protection of beneficial uses* of water or the prevention of nuisance within a specific area."[2] (Wat. Code, § 13050(h), emphasis added.) When establishing WQOs, the state must consider a series of factors, including economics, attainability, and other public interest factors. (See Wat. Code, § 13241.) As the SWRCB's

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[2] Beneficial uses may include, but are not limited to, "domestic, municipal, agricultural and industrial supply; power generation; recreation; aesthetic enjoyment; navigation; and preservation and enhancement of fish, wildlife, and other aquatic resources or preserves." (Wat. Code, § 13050(f).)

Chief Counsel has previously explained, Porter-Cologne requires that "*objectives must be reasonable,* and economic considerations are a necessary part of the determination of reasonableness." (*Memorandum to Regional Water Board Executive Officers from William R. Attwater, Chief Counsel, State Water Resources Control Board* (Jan. 4, 1994), at p. 3, emphasis added.) In adopting WQOs, the SWRCB must ensure that the WQOs provide for the reasonable protection of beneficial uses after considering the factors required by Water Code section 13241, including economics and attainability. (See *United States v. State Water Resources Control Bd.* (1986) 182 Cal.App.3d 82, 109-110 [the SWRCB "is required to 'establish such water quality objectives . . . as in its judgment will ensure the reasonable protection of beneficial uses . . .'"] (citing Wat. Code, § 13241); *id.* at p. 118 [the SWRCB shall consider "all competing demands for water in determining what is a reasonable level of water quality protection."].)

*E. Hydrologic Modeling Using the Best Available Information Indicates That Implementation of New January-June Delta Water Quality Objectives Reflecting 50% Or 40% of Unimpaired Flows Would Have Severe Hydrologic Impacts*

The 2010 Delta Flow Criteria report issued by the SWRCB suggested that current levels of Delta flows are inadequate to protect aquatic public trust resources in the Delta, and that flows in the Delta should approximate 75% of unimpaired Delta outflow from January through June, and 75% of unimpaired Sacramento River inflow from November through June. The SWRCB stated, at the time that it released the Delta Flow Criteria report, that the report should not be used for regulatory purposes, but nevertheless indicated that it would develop future "Delta flow objectives with regulatory effect." (See 2010 Delta Flow Report, at p. 16.) In addition, numerous parties – including the SWRCB itself – have embraced the basic concepts that there should be additional flows in the Delta, and that such flows should based on a percentage of unimpaired flows.

Since the SWRCB, and other parties, have conceived of developing water quality objectives using the metric of unimpaired flows, the SVWU retained Walter Bourez, of MBK Engineers, to analyze the potential effect of a flow regime based on a percentage of unimpaired flows. Mr. Bourez's report is attached as Exhibit 2 (hereafter MBK Report), and incorporated herein by reference.

Mr. Bourez's analysis began with determining the average percentages of unimpaired Delta outflows that would have occurred in different water-year types if Existing Conditions had been in effect during the entire period of historical record. Consistent with standard hydrological modeling practice, Existing Conditions are defined by today's regulatory requirements, land use, water demands, and facilities and are used to establish how the CVP/SWP currently operates.[3] This analysis determined that, under Existing Conditions, average January-June Delta outflow

[3] As explained in the MBK Report at 1, the Existing Conditions percentage of unimpaired Delta outflow is calculated by averaging total modeled Delta outflows for the period of January through June and dividing by the average total unimpaired Delta outflow over that same period. The outflows were not calculated on a month-to-month basis for the initial analysis to determine Existing Conditions percentage of unimpaired Delta outflow.

over the period of record is about 50% of unimpaired flows and the critical year average Delta outflow is about 40% of unimpaired flows.

These average percentages of 50% and 40% of unimpaired flows then were modeled, in separate analyses, as minimum *monthly* Delta flow requirements, for each month in the January through June period, to estimate the hydrological and related impacts that would result from implementation of such minimum requirements. As such, the MBK Report presents the estimated impacts that would occur if the existing average and average critical year percentages of unimpaired Delta outflows during the January through June period – 50% and 40%, respectively – were imposed as regulatory minimum Delta outflow requirements *for each separate month* from January through June. This approach of applying a constant percentage of unimpaired flow as a requirement for each month from January through June is consistent with the SWRCB August 2010 Delta Flow Criteria report and recent analysis performed by the SWRCB on certain tributaries to the San Joaquin River as part of its update to the Bay-Delta Plan

The overall conclusions regarding the estimated effects of implementing January-June minimum monthly Delta outflow requirements of 50% and 40% of unimpaired flows are as follows:

- Effects to the water system would be severe and would result in the inability to maintain viable water system operations.

- Increase in average annual Delta outflow
  - 50% unimpaired requirement: 1.1 MAF
  - 40% unimpaired requirement: 480 TAF

- Decrease in Sacramento Basin project reservoir carryover storage
  - Significant reductions in cold water pools under both analysis
  - 50% unimpaired requirement: 2.2 MAF average reduction
  - 40% unimpaired requirement: 1.1 MAF average reduction

- Increase in Sacramento Basin groundwater pumping
  - Groundwater pumping in the 50% scenario: 250 TAF average annual, 1 MAF average in Critical years
  - Groundwater pumping in the 40% scenario: 100 TAF average annual, 400 TAF average in Critical years

- Neither of these estimated pumping amounts could be sustained, so reductions in irrigated acreages would have to occur.

- Increased groundwater overdraft in export service area

- Seasonal changes in river flow and Delta outflow
    - Increases in March through June
    - Decreases in July through December
    - Impacts to key instream temperature and habitat

- Regular and multiple violations in existing SWRCB standards and ESA Biological Opinion requirements.

- Severe water supply impacts
    - Impacts to diversions by Central Valley Project (CVP) settlement and exchange contractors, and State Water Project (SWP) settlement agreement holders
    - Inability to meet public health and safety water deliveries
    - Refuge delivery reductions

*F. Under Porter-Cologne and CEQA, the SWRCB Must Analyze the Numerous Impacts That Would Occur if the SWRCB Were to Adopt New Delta Water Quality Objectives Based on 50% or 40% of Unimpaired Flows*

MBK's analysis demonstrates that implementation of new Delta water quality objectives based on 50% or 40% of January-June unimpaired flows would have very significant hydrological impacts, because implementation of such objectives would significantly reduce storage in the Sacramento Valley's reservoirs, cause significant shifts in streamflow in the Valley's rivers, and significantly reduce water-supply deliveries both in the Sacramento Valley and in export areas.

Accordingly, if the SWRCB were to consider new Delta water quality objectives based on 50% or 40% of unimpaired flows, Porter-Cologne and CEQA would require the SWRCB to consider numerous significant impacts that implementation of such objectives would cause. (See Pub. Resources Code, § 21080.5, subds. (d)(2)(A), (d)(3)(A); Wat. Code, § 13241; Cal. Code Regs., tit. 14, §§ 15250, 15252.) The significant impacts that Porter-Cologne and CEQA require the SWRCB to analyze would include impacts in the following categories:

- <u>Special-status and migratory fisheries</u> – MBK's analysis demonstrates that implementing Delta water quality objectives based on 50% or 40% of January-June unimpaired flows would substantially reduce cold-water storage in the Sacramento Valley's reservoirs. As a result, summer and fall water temperatures in the Sacramento Valley's rivers likely would increase significantly, probably resulting in significant impacts on rearing and spawning salmonids, including at least winter-run Chinook salmon, spring-run Chinook salmon, fall-run Chinook salmon, late fall-run Chinook salmon and steelhead. As the SWRCB is aware, winter-run Chinook salmon, spring-run Chinook salmon and steelhead are listed under the federal Endangered Species Act, as is green sturgeon. The impacts on these species would be particularly severe in multi-year droughts because, as MBK's analysis demonstrates, implementation of Delta water quality objectives based on 50% or 40% of unimpaired flows would cause reservoir storage to be severely reduced – indeed, completely depleted – for many months during such droughts. (MBK Report Figs., 14-17.) For example, MBK's analysis shows that, in a repeat of the 1987-1992 drought, Shasta and Folsom Reservoirs would reach dead pool in the summers and falls of multiple years of that drought. (MBK Report Figs. 15, 17.) The resulting temperature impacts on multiple cohorts of Central Valley salmon would be devastating if such a scenario were to actually occur.

In addition, MBK's analysis demonstrates that implementing Delta water quality objectives based on 50% or 40% of unimpaired flows would cause significant shifts of streamflows in the Sacramento Valley's rivers from the summer and fall months to the spring months. These shifts would also probably cause significant impacts on rearing and spawning salmonids, including at least winter-run Chinook salmon, spring-run Chinook salmon, fall-run Chinook salmon, late fall-run Chinook salmon and steelhead.

Furthermore, an April 2011 report, prepared by the highly respected fisheries biologist David Vogel of Natural Resources Scientists, Inc., and entitled, *Insights into the Problems, Progress, and Potential Solutions for Sacramento River Basin Native Anadromous Fish Restoration,*[4] reveals that implementing these types of unimpaired flow based objectives could undermine 20 years of work to improve conditions for salmon in the Sacramento Valley.

Such significant impacts on special-status and migratory species require analysis under CEQA. (See Cal. Code Regs., tit. 14, Appendix G, items IV.a) and IV.d).) These impacts will reach levels that mandate a finding of significance. (See Cal. Code Regs., tit. 14, Appendix G, item XVIII.a).)

- Water supplies – As demonstrated by MBK's analysis, implementation of Delta water quality objectives based on 50% or 40% of January-June unimpaired flows would substantially reduce reservoir storage and summer and fall streamflows in the Sacramento Valley. Because California's climate generally is dry in the summer and fall, these hydrological impacts probably would result in significant water-supply shortages for all consumptive uses in many years, and particularly in dry cycles. The water-supply impacts would not be limited to those caused by the fact that streamflows and bypass-flow requirements would be increased and reservoir storage to meet dry-season demands would be decreased. For example, the significant impacts on water storage in Folsom Reservoir could cause the reservoir's level to drop below public water suppliers' intakes in many years, and for multiple months during dry cycles. In such cases, implementing water quality objectives based on 50% or 40% of unimpaired flows could have serious impacts on public health and safety because it would not be physically possible to draw water from Folsom Reservoir. Such effects would trigger a mandatory finding of significance. (See Cal. Code Regs., tit. 14, Appendix G, item XVIII.c).) Porter-Cologne requires that the SWRCB consider all water-supply impacts because it requires the

[4] This document is attached hereto as Exhibit 3, and incorporated herein by reference.

SWRCB to consider, in developing water quality objectives, "[p]ast, present, and probable future beneficial uses of water" and "economic considerations," among other factors. (Wat. Code, § 13241, subds. (a), (d).)

- Groundwater supplies and contamination – As MBK's report discusses, the loss of surface water supplies as the result of implementing water quality objectives based on 50% or 40% of January-June unimpaired flows would have significant impacts on groundwater resources. These impacts would occur for multiple reasons.

  First, in order to attempt to maintain economically viable communities and operations, Sacramento Valley water users would have to pump significantly more groundwater. For example, modeling of the effects of implementing objectives reflecting 50% of unimpaired flows causes CalSim II to model that 997,000 acre-feet of groundwater would be pumped in the Sacramento Valley in critical years. (MBK Report Figs. 8, 10.) While this level of groundwater pumping would be unsustainable, it demonstrates that implementing water quality objectives based on 50% or 40% of unimpaired flows would result in severe groundwater impacts. If the SWRCB considers adopting and implementing such water quality objectives, then it must analyze the resulting significant impacts on groundwater supplies. (See Cal. Code Regs., tit. 14, Appendix G, item IX.b).)

  Second, the reduced amount of surface deliveries would reduce the amount of groundwater recharge that currently occurs from the application of surface water to beneficial uses, and also from the planned percolation of surface water through earthen conveyance systems as part of conjunctive use programs. (See Cal. Code Regs., tit. 14, Appendix G, item IX.b).)

  Third, the increased groundwater pumping that would be triggered by the reductions in surface supplies likely would cause existing contamination plumes to expand and migrate. There are a number of such plumes in the Sacramento metropolitan area associated with former military and aerospace facilities. The expansion and migration of these plumes would be a significant impact. (See Cal. Code Regs., tit. 14, Appendix G, items IX.a), IX.f).)

- Farmland and Associated Terrestrial and Migratory Bird Species – The water-supply reductions resulting from any implementation of Delta water quality objectives based on 50% or 40% of January-June unimpaired flows would result in significant environmental impacts to farmland. If such objectives were implemented, it would not be possible to sustain the levels of groundwater pumping that would be necessary to replace the lost surface supplies. For example, MBK's analysis indicates that an unsustainable 997,000 acre-feet of pumping would be necessary in the Sacramento Valley in critical years to replace the lost surface supplies. (MBK Report Figs. 8, 10.) A great deal of farmland therefore would be lost, which would be a significant environmental impact. (See Cal. Code Regs., tit. 14, Appendix G, item II.a).)

The loss of this farmland would result in the loss of habitat for terrestrial species that currently occupy irrigated farmland. The impacts on these terrestrial species and their habitats likely would be significant and potentially would reach levels that mandate a finding of significance. (See Cal. Code Regs., tit. 14, Appendix G, items IV.a), IV.b), XVIII.a).)

The loss of farmland in the Sacramento Valley also would impact migratory bird species that use the irrigated lands for habitat as part of the Pacific Flyway. The habitat values created by these irrigated lands are described in detail in the Central Valley Joint Venture 2006 Implementation Plan (www.centralvalleyjointventure.org/science). Such impacts would be significant. (See Cal. Code Regs., tit. 14, Appendix G, items IV.a), IV.b), IV.d).)

- Wildlife Refuges – There are numerous wildlife refuges in the Sacramento Valley that are supplied with surface water. Reduced surface-water supplies would reduce the amount of water available for those refuges. The species that use the refuges as habitat would be impacted by the implementation of Delta water quality objectives based on 50% or 40% of January-June unimpaired flows. Such impacts would be significant. (See Cal. Code Regs., tit. 14, Appendix G, items IV.a), IV.b), IV.d).)

- Hydroelectric generation, air quality and greenhouse gasses – The reduced reservoir storage and significant seasonal shifts in streamflows resulting from any implementation of water quality objectives based on 50% or 40% of January-June unimpaired flows would significantly impact hydroelectric generation. There would be at least two significant impacts on hydroelectric generation. First, generation would be shifted from the high-demand summer and fall months to the low-demand spring months. Second, lost storage would reduce the amount of water available to generate electricity to meet temporary demand peaks, such as during weekday summer afternoons. The SWRCB must consider such impacts under Porter-Cologne. (See Wat. Code, § 13241, subds. (a), (d).) Because this lost generation would have to be replaced by new facilities, this impact also must be considered under CEQA. (See Cal. Code Regs., tit. 14, Appendix G, item XIV.a).)

  Because lost hydroelectric generation likely would be replaced by generation with the same operating characteristics as hydro power, the SWRCB also must consider the potential air quality and greenhouse-gas impacts that would be associated with the required replacement generation. (See Cal. Code Regs., tit. 14, Appendix G, items III.a)-c), VII.a)-b).) In light of these potential impacts, the California Global Warming Solutions Act of 2006 – AB 32 – also would require the SWRCB to consider the greenhouse-gas impacts of implementing water quality objectives based on 50% or 40% of unimpaired flows. (Health & Saf. Code, § 38592, subd. (a).)

  Finally, because groundwater pumping would increase significantly under both the 50% and the 40% scenario, there would be either more use of diesel-fueled groundwater pumps or increased electrical demand because of increased pumping using electrical pumps. In either case, there would be air quality impacts because more fossil fuels would need to be burned to meet the additional pumping demands.

- Riparian Habitat – The dramatic hydrologic changes that implementing water quality objectives based on 50% or 40% of January-June unimpaired flows would cause, and the resulting increased groundwater pumping, would cause soils and groundwater aquifers to be drier, increasing induced recharge from streambeds and causing drier conditions in the Sacramento Valley's riparian habitat. Implementing such objectives therefore would adversely impact the Sacramento Valley's riparian habitat and that impact could be significant. (See Cal. Code Regs., tit. 14, Appendix G, item IV.b).)

- Aesthetics, Recreation and Lake Fisheries – The Sacramento Valley's reservoirs provide aesthetic enjoyment for the communities that have grown around them, and for people who use them for recreation. The severe impacts on reservoir storage resulting from implementing water quality objectives based on 50% or 40% of January-June unimpaired flows would cause those reservoirs to become much less pleasing aesthetically as they would feature large "bathtub rings" much more often. In addition, the significant shift of streamflows in the Sacramento Valley's rivers from the high-recreation summer months to the low-recreation spring months would cause those rivers to become much less attractive to the public during the time of maximum exposure. These aesthetic impacts would be significant. (See Cal. Code Regs., tit. 14, Appendix G, items I.a), I.b), I.c).) These impacts also would reduce the value of numerous recreational resources, including the Sacramento Valley's whitewater rafting streams as well as its reservoirs. These impacts also would be significant, partly because there would be an indirect impact of shifting recreational demands to other resources that presumably would have to be expanded. (See Wat. Code, § 13241, subds. (a), (d); Cal. Code Regs., tit. 14, Appendix G, item XV.b).) Finally, the severe reservoir storage impacts would affect the habitat for lake fish, which impact could be significant. (See Cal. Code Regs., tit. 14, Appendix G, item IV.d).)

- Population – Reliable and affordable water supplies are a key economic asset of the Sacramento Valley. Due to the significant impacts throughout the Sacramento Valley that would result from implementing water quality objectives based on 50% or 40% of unimpaired flows, the value of this key asset would be reduced, and there likely would be at least some shift of population out of the Valley to other areas of California. This population shift would be a significant impact that CEQA would require the SWRCB to analyze. (See Cal. Code Regs., tit. 14, Appendix G, items XIII.a), XIII.c).)

G. *The SWRCB Must Analyze the Reasonable Alternative of Establishing Any New Water Quality Objectives Concerning Delta Streamflows, Based on the Accumulation of Existing State-of-the-Art Streamflow Requirements in the Sacramento Valley*

The baseline for CEQA analysis normally is the physical environmental conditions existing when the NOP is published. (Cal. Code Regs., tit. 14, § 15125, subd. (a).) In addition, under CEQA, the lead agency must consider project alternatives that would avoid or reduce significant or potentially significant environmental impacts. (Pub. Resources Code, §§ 21001, subd. (g); 21002; 21002.1, subd. (a); 21061; 21080.5, subds. (d)(2)(A), (d)(3)(A); Cal. Code Regs., tit. 14, §§ 15126.6(a); 15252, subd. (a)(2)(A).) In light of the numerous significant environmental impacts that would result from implementing water quality objectives based on 50% or 40% of January-June unimpaired flows, the SWRCB must consider project alternatives.

The baseline for the SWRCB's CEQA document must include the Delta inflows from the Sacramento River that presently occur as a result of recently-adopted streamflow requirements on Sacramento Valley rivers. In addition, a reasonable project alternative that must be evaluated would base any new water quality objectives for Delta streamflows on such inflows from the Sacramento River. In this regard, and as described in more detail in the September 2011 document entitled *Instream Flow Requirements in the Sacramento River Hydrologic Region*,[5] major rivers in the Sacramento River basin already are governed by streamflow requirements that state and federal regulatory agencies believe protect beneficial uses and that are based on the best available science. In summary, the applicable requirements are as follows:

- American River – Implementation of the streamflow standards stated in the Water Forum's 2006 flow management standard (FMS) through those standards' incorporation by the National Marine Fisheries Service (NMFS) into NMFS's 2009 biological opinion for the operation of the CVP and the SWP;

- Bear River – The SWRCB approved, in Order WR 2000-10, water-right changes necessary to implement a settlement agreement among the Department of Water Resources, South Sutter Water District and Camp Far West Irrigation District concerning the responsibility of water users on the Bear River for contributing to meeting Delta flow objectives;

- Feather River – Streamflow requirements adopted by the SWRCB in the 2010 water quality certification for the relicensing of the Department of Water Resources' Oroville facilities;

- Sacramento River – Streamflow standards including those stated in the SWRCB's Orders 90-05 and 91-01 and in NMFS's 2009 biological opinion for the CVP and the SWP; and

[5] This document is attached hereto as Exhibit 4, and incorporated herein by reference.

- Yuba River – The Lower Yuba River Accord's streamflows standards, as implemented by the SWRCB in its Corrected Order 2008-0014.

These current streamflow requirements generally reflect substantial collaborative work among water users, fishery agencies and environmental groups to simultaneously meet the streamflow needs of sensitive fisheries, and the water-supply needs of the Sacramento Valley's communities. In addition, these streamflow requirements generally have taken effect since the recognition of the Delta's pelagic organism decline and, in most cases, have taken effect since 2006.

The Sacramento Valley's existing streamflow requirements, therefore, reflect very recent science to support salmonids. Also, as discussed above and in detail in the MBK report regarding Delta outflow requirements that would be based on 40% and 50% of unimpaired flows, any such requirements would have significant adverse impacts on river flows and water temperatures. This, in turn, would significantly and adversely impact salmonids. Furthermore, there is no indication that the Sacramento Valley's existing streamflow requirements together do not produce sufficient Sacramento River inflows to the Delta to support the Delta's pelagic fish. This latter point is demonstrated both by MBK's above-referenced April 2012 report, and the December 2011 report entitled, *Relating Delta Smelt Index to X2 Position, Delta Flows, and Water Use*.[6] MBK's April 2012 report demonstrates that there has been no significant change in January-June Sacramento River inflows to the Delta, as a percentage of unimpaired flows, since 1944. (MBK Report Fig. 5.) As the SWRCB is aware, the Delta's pelagic fisheries were healthy for much of the post-1944 period. The December 2011 report summarizes available data, which indicates that there is no correlation between Sacramento Valley water use and the decline of the Delta's pelagic fisheries. Given this information, and the fact that existing Sacramento Valley streamflow requirements are recent and generally reflect extensive collaborative efforts to improve conditions for salmonids, a reasonable project alternative would be to base any new flow-related Delta water quality objectives on the Sacramento River inflows to the Delta resulting from operations under those existing streamflow requirements. The SWRCB must consider this project alternative because CEQA requires that a lead agency consider all reasonable project alternatives. (*Citizens of Goleta Valley*, *supra*, 52 Cal.3d, at pp. 564-566; *In re Bay-Delta Programmatic Environmental Impact Report Coordinated Proceedings* (2008) 43 Cal.4th 1143, 1162-1163.)[7]

Finally, as noted above, Porter-Cologne requires that the SWRCB establish WQOs that provide reasonable protection to beneficial uses. In most of the above-referenced collaborative processes, state and federal agencies focused their attention on protecting a broad range of beneficial uses, from recreation to fisheries to terrestrial species. Those judgments, based on

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[6] This document is attached hereto as Exhibit 5, and incorporated herein by reference.

[7] Similarly, Mr. Vogel's above-referenced and attached report (see Exh. 3), recommends numerous actions that could be undertaken to reduce mortality to anadromous fish in the Delta by fixing the serious predation and site-specific habitat problems in the Delta. This alternative for protecting these beneficial uses would not cause the severe and unreasonable impacts resulting from any new objectives based upon a percentage of unimpaired flows. As such, the SWRCB must analyze this approach as an alternative.

current science, should only be modified by the SWRCB if it is clear, based on the record in front of the SWRCB, that these settlements do not protect beneficial uses. To use the example of delta smelt and X2, it would not be appropriate for the SWRCB to conclude that Sacramento River inflows to the Delta must be increased to move X2 closer to the Golden Gate Bridge, in light of the data presented by the above-referenced December 2011 report (Exhibit 5 hereto), which shows no correlation between delta smelt abundance and water use in the Sacramento Valley. Moreover, because most of these settlements and the associated regulatory regimes have only been in place for a few years (mostly during the 2007-2009 drought), it would be inappropriate and premature for the SWRCB to conclude – at the present time – that these regulatory standards have failed to protect beneficial uses.[8]

We appreciate the SWRCB's consideration of these comments, and look forward to participating in the scoping meeting on May 26, 2012.

Sincerely,

SOMACH SIMMONS & DUNN

By______________________
Andrew M. Hitchings, Attorneys for
Glenn-Colusa Irrigation District

DOWNEY BRAND LLP

By______________________
David R.E. Aladjem, Attorneys for
Reclamation District 108, Calaveras County Water District, Meridian Farms Water Company, Natomas Central Mutual Water Company, Pelger Mutual Water Company, River Garden Farms Company, South Sutter Water District, Sutter Extension Water District, Sutter Mutual Water Company and Sacramento Municipal Utility District

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[8] In particular, the currently controlling NMFS Biological Opinion for the CVP and SWP operations was not adopted until June 4, 2009. As such, there have been less than three full irrigation seasons to assess its efficacy.

BARTKIEWICZ, KRONICK & SHANAHAN

By Alan B. Lilly

Alan B. Lilly, Attorneys for
Browns Valley Irrigation District, City of Folsom, City of Roseville, Sacramento Suburban Water District, San Juan Water District, Yolo County Flood Control & Water Conservation District, and Yuba County Water Agency

MINASIAN, MEITH, SOARES, SEXTON & COOPER, LLP

By Jeffrey Meith

Jeffrey Meith, Attorneys for
Western Canal Water District, Richvale Irrigation District and Biggs-West Gridley Water District

Attachments
cc: (*via email w/o attachments*)
Charles R. Hoppin, SWRCB Chair
Frances Spivy-Weber, SWRCB Vice Chair
Tam M. Doduc
John Laird
Dr. Jerry Meral
Matthew Rodriquez

AMH:cr

# EXHIBIT 1

## PARTIES

Biggs-West Gridley Water District

Browns Valley Irrigation District

Calaveras County Water District

City of Folsom

City of Roseville

Glenn-Colusa Irrigation District

Meridian Farms Water Company

Natomas Central Mutual Water Company

Pelger Mutual Water Company

Reclamation District 108

Richvale Irrigation District

River Garden Farms Company

Sacramento Municipal Utility District

Sacramento Suburban Water District

San Juan Water District

South Sutter Water District

Sutter Extension Water District

Sutter Mutual Water Company

Western Canal Water District

Yolo County Flood Control & Water Conservation District

Yuba County Water Agency

# EXHIBIT 2

# Evaluation
# Of
# Potential
# State Water Resources Control Board
# Unimpaired
# Flow
# Objectives

**April 25, 2012**

**Prepared for: Sacramento Valley Water Users Group**
**Prepared by: MBK Engineers**

# EXECUTIVE SUMMARY

This report was prepared to support the Sacramento Valley Water Users in submitting comments to the State Water Resources Control Board (SWRCB) regarding proposed Delta outflow and Sacramento River flow requirements that would be based on percentages of unimpaired flows, and potentially included as water quality objectives in the SWRCB's update and implementation of the Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (Bay-Delta Plan). This report summarizes the results of a reconnaissance level analysis of the estimated effects that implementation of such requirements would have on water users in the Sacramento River Basin and on CVP/SWP reservoirs and operations.

Initially, an analysis was performed to determine the average percentages of unimpaired Delta outflows that would have occurred in different water-year types if Existing Conditions had been in effect during the entire period of historical record. Consistent with standard hydrological modeling practice, Existing Conditions are defined by today's regulatory requirements, land use, water demands, and facilities and are used to establish how the CVP/SWP currently operates. Existing Conditions percentage of unimpaired Delta outflow is calculated by averaging total modeled Delta outflows for the period of January through June and dividing by the average total unimpaired Delta outflow over that same period. The outflows were not calculated on a month-to-month basis for the initial analysis to determine Existing Conditions percentage of unimpaired Delta outflow. This analysis determined that, under Existing Conditions, average January-June Delta outflow over the period of record is about 50% of unimpaired flows and the critical year average Delta outflow is about 40% of unimpaired flows.

These average percentages of 50% and 40% of unimpaired flows then were modeled, in separate analyses, as minimum monthly Delta flow requirements for each month in the January through June period to estimate the hydrological and related impacts that would result from implementation of such minimum requirements. In other words, this report presents the estimated impacts that would occur if the existing average and average critical year percentages of unimpaired Delta outflows during the January through June period – 50% and 40%, respectively – were imposed as regulatory minimum Delta outflow requirements for each separate month from January through June. The approach of applying a constant percentage of unimpaired flow as a requirement for each month from January through June is consistent with the SWRCB August 2010 Delta flow criteria report and recent analysis performed by SWRCB on certain tributaries to the San Joaquin River as part of its update to the Bay-Delta Plan

The overall conclusions are summarized in the following list, and the detailed analytical results are summarized in this report. The overall conclusions regarding the estimated effects of implementing January-June minimum monthly Delta outflow requirements of 50% and 40% of unimpaired flows are as follows:

- Effects to the CVP and SWP reservoirs and operations would be severe and would result in the inability to maintain viable operations
- Increases in average annual Delta outflows would be:
  - 1,100,000 acre-feet for a 50% of unimpaired flows requirement; and
  - 480,000 acre-feet a 40% of unimpaired flows requirement
- The following reductions and decreases in Sacramento Basin CVP and SWP reservoir carryover storage would occur:

- Significant reductions in cold water pools would occur under both the 50% and the 40% of unimpaired flows scenarios
    - An average reduction of 2,200,000 acre-feet in reservoir carryover storage would occur under the 50% of unimpaired flows scenario
    - An average reduction of 1,000,000 acre-feet in reservoir carryover storage would occur under the 40% of unimpaired flows scenario
- The following increases in Sacramento Basin groundwater pumping to meet reductions in surface-water deliveries would be necessary:
    - For the 50% of unimpaired flows scenario, groundwater pumping in the Sacramento Basin would have to increase by 250,000 acre-feet per year on average annual basis , and by an average of 1,000,000 acre-feet per year in Critical years
    - For the 40% of unimpaired flows scenarios, groundwater pumping in the Sacramento Basin would have to increase by 100,000 acre-feet per year on average annual, and by an average of 400,000 acre-feet per year in Critical years
- Such increases in groundwater pumping would not be realistic and therefore would not actually occur. Instead, there would have to be reductions in irrigated acreage
- Under both scenarios, there would be increased groundwater overdrafts in the export service area
- The following seasonal changes in river flows and Delta outflows and impacts would occur:
    - Increases in March through June
    - Decreases in July through December
    - Impacts to key instream temperature and habitat
- There would be regular and multiple violations of existing SWRCB standards and ESA Biological Opinion requirements
- There would be severe water supply impacts, including the following:
    - Water-supply impacts to CVP settlement and exchange contractors, and SWP settlement agreement holders, which have water rights senior to the CVP and the SWP
    - Significant reductions in north-of-Delta CVP and SWP water-service contract deliveries.
    - Inability to meet public health and safety water deliveries
    - Reductions in water deliveries to wildlife refuges

# UNIMPAIRED FLOW

For hydrological analyses, unimpaired flows are the calculated flows that the Department of Water Resources (DWR) has developed to estimate the flow conditions that would have occurred in the absence of any human alterations of flows. These estimated unimpaired flows have been calculated by taking the stream flow conditions that actually occurred and by subtracting the effects of reservoir storage, water diversions, resulting return flows, and other factors that were caused by human influences on flows.

Unimpaired flow data used for this evaluation were provided by DWR and published in the 2006 report titled: *California Central Valley Unimpaired Flow Data, Fourth Edition*. DWR defines unimpaired flow on page 1 of this report as:

> *"Unimpaired flow is runoff that would have occurred had water flow remained unaltered in rivers and streams instead of stored in reservoirs, imported, exported, or diverted. The data is a measure of the total water supply available for all uses after removing the impacts of most upstream alterations as they occurred over the years. Alterations such as channel improvements, levees, and flood bypasses are assumed to exist."*

The State Water Resources Control Board (SWRCB) has suggested that it may establish new Delta outflow and Sacramento River flow requirements that are based on specified percentages of unimpaired flows. The SWRCB's August 2010 Delta Flow Criteria report suggested that in order to protect aquatic public trust resources in the Delta, 75% of unimpaired Delta outflow would be necessary from January through June, and that 75% of unimpaired Sacramento River flow would be needed for these months, as well as for November and December. The SWRCB has also analyzed the potential imposition of 20%, 40% and 60% unimpaired flow requirements on certain tributaries to the San Joaquin River as part of its update to the Bay-Delta Plan.

The percentages of unimpaired flow that flow into and out of the Delta are highly variable and are influenced by hydrologic conditions, historical development, and regulatory requirements. Fluctuating hydrologic conditions are the dominant factor contributing to variations in the percentages of unimpaired flow that occur over time at various locations in the Delta watershed. Historical development has influenced the percentages of unimpaired flows that have occurred as project reservoirs have been developed. However, it is not possible to ascertain the precise effects of these developments by analyzing historical data, because these data are heavily influenced by changes in hydrologic conditions. Regulatory conditions have also influenced the percentages of unimpaired flow that have occurred, particularly during summer and fall months where regulatory minimum river flow and Delta outflow requirements are greater than the corresponding unimpaired flows.

Because current operating requirements have only been in place for a short period of time, there is not enough available historical data to estimate the Existing Conditions percentage of unimpaired Delta outflow. Therefore standard hydrological modeling practice is to analyze the hydrologic impacts that would occur when current cultural and regulatory conditions – Existing Conditions – are applied to the variable hydrology that has occurred over a period of record. This approach enables projections about what effects existing requirements, or possible new requirements, will have going forward. In this report, to determine the average percentage of unimpaired Delta outflows that would occur, Existing Conditions are applied to a long-term hydrologic period, CalSim II is used to depict streamflows and those modeled streamflows then are compared to DWR's unimpaired flow data to estimate the Existing Conditions percentage of unimpaired Delta outflow. Actual historical flow data are included in this report to provide a historical perspective on the modeled percentages of unimpaired flow over the period of record under Existing Conditions. That comparison demonstrates that the modeled data is sufficiently reliable for analytical purposes.

Figure 1 is a plot of historical average monthly Delta outflows as percentages of average monthly unimpaired Delta outflows for the following periods:

- 1930-1943: Pre-Shasta Reservoir
- 1944-1955: Pre-Folsom Reservoir
- 1956-1968: Pre-Oroville Reservoir
- 1969-2003: Post Sacramento Basin Project Reservoirs
- All years: 1930-2003

During 1969 through 2003, hydrologic conditions varied significantly and regulatory standards became more stringent. Figure 2 is a plot showing average January through June historical Delta outflows during the 1969-2003 period as percentages of unimpaired Delta outflows for the same period of each year. Each data point is labeled with the Sacramento River Basin 40-30-30 index water year type. The average percentages of unimpaired flow for each water year type during the 1969-2003 period are listed in Table 1. Values in Table 1 are calculated by taking the average of total January through June historical flows divided by average total January through June unimpaired flows and is expressed in the following equation:

$$Average\left(\sum January\ through\ June\ historical\ flow\right) \div Average\left(\sum January\ through\ June\ unimpaired\ flow\right)$$

This equation can be used to calculate:(1)average percentage of unimpaired flow for all years; (2) percentages for each year type, as displayed in Table 1; and (3) average percentages based on a comparison of modeled flows over the period of record and DWR's calculated unimpaired flows. As indicated by this table, Delta outflows in wetter years tend to be higher percentages of unimpaired outflows, while Delta outflows in drier years tend to be lower percentages of unimpaired outflows. These differences generally occur because reservoir storage capacity does not change with changes in water year types, and reservoirs therefore are capable of storing a greater percentage of unimpaired flows in drier years than in wetter years.

**Figure 1 – Average Historical Delta Outflow as a Percentage of Unimpaired Delta Outflow**

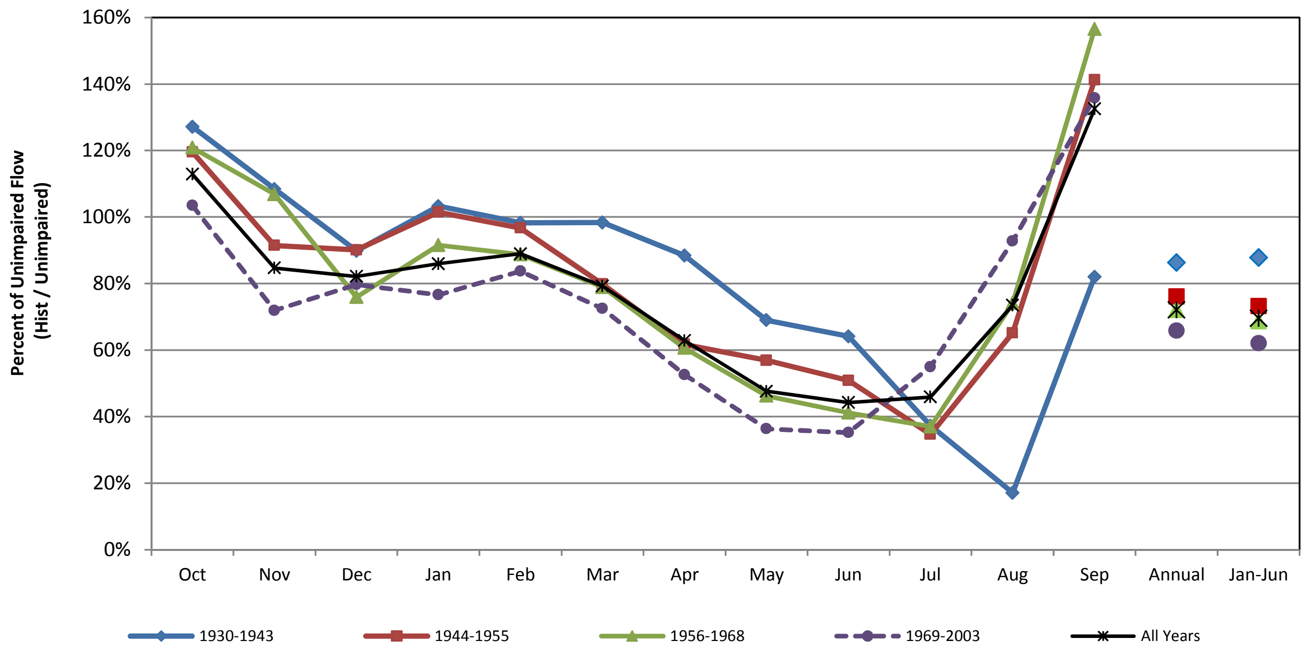



**Figure 2 - Historical 1969-2003 Average January through June Historical Delta Outflow as a Percentage of Unimpaired Delta Outflow**

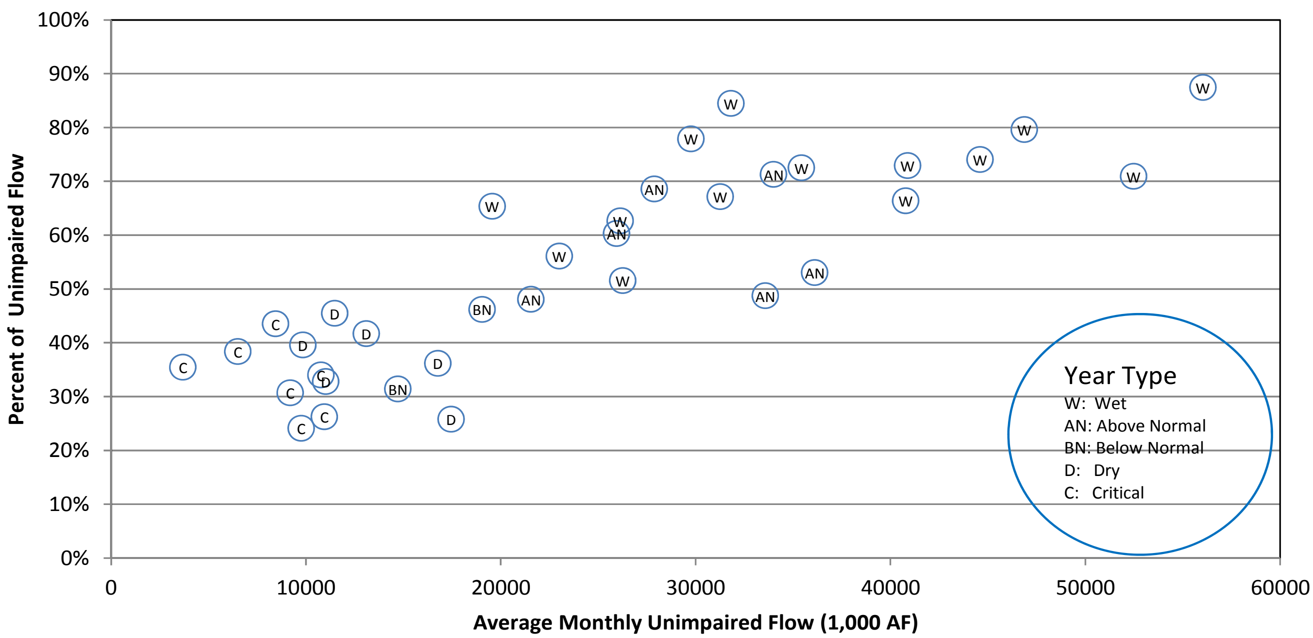



**Table 1 - Historical 1969-2003 Average January through June Historical Delta Outflow as a Percentage of Unimpaired Delta Outflow by SRI Water Year Type**

| Wet | Above Normal | Below Normal | Dry | Critical | All Years |
|---|---|---|---|---|---|
| 72% | 59% | 40% | 36% | 32% | 62% |

Due to the difficulties in using historical records to determine the average percentage of unimpaired flows that flow into and out of the Delta under Existing Conditions, an evaluation of CalSim II results was performed to estimate what Delta outflows would occur as percentages of unimpaired flows under Existing Conditions, under the variable hydrology that occurred during the 1922-2003 period of record. CalSim II is designed to represent existing CVP/SWP operating and system conditions by using existing operating criteria, facilities, and land use to model the CVP/SWP system and Delta for the 1922-2003 hydrologic period. Using CalSim II to determine the percentage of unimpaired Delta outflows that occur under this Existing Conditions scenario, and then using the average unimpaired outflow percentage developed from this scenario to create new model runs with these average percentage as minimum monthly Delta outflow requirements is the best available method of estimating what might happen if one of these existing percentages were implemented as a minimum Delta outflow requirement.

Figure 3 is a plot showing, by water year type, the monthly average modeled Delta outflows for the 1922-2003 period of record as percentages of monthly average unimpaired Delta outflows over the same period. Because Existing Conditions operating criteria are the same in every year of this CalSim II simulation, variations due to fluctuating hydrologic conditions can be more easily identified under this approach. For example, the percentages that modeled Delta outflows are of unimpaired flows for March vary from 40% in dry years to 78% in wet years. Figure 4 is a plot showing the average January through June modeled Delta outflow percentages of unimpaired Delta outflows for each year. Each data point is labeled with its water year type in this figure. The average percentages that modeled Delta outflows are of unimpaired flows for each water year type are listed in Table 2. In wetter years, modeled Delta outflows tend to be higher percentage of unimpaired outflows, averaging 65%, while in drier years modeled Delta outflows tend to be lower percentage of unimpaired outflow, averaging 40%.

The CalSim II modeling results indicate that over the 1922-2003 period of record, the average modeled Delta outflows under Existing Conditions is 53% of unimpaired outflows for the January through June period; the average percentage for critical years is 40%. To estimate the effects of imposing the existing average January through June percentage of unimpaired flow as a Delta outflow requirement, the value of 50% (rounded down from 53% to ensure that the effects are not overestimated) then is used as a minimum monthly regulatory requirement in further analysis. For the purpose of this further analysis, it is assumed that the 50% of unimpaired flow requirement is applied on a monthly basis from January through June, i.e., for each month from January through June, Delta outflow must be equal to or greater than 50% of unimpaired Delta outflow for that month. A second stage in the further analysis then was performed to estimate the effects of imposing the average January through June critical year Delta outflow percentage of unimpaired flows, 40%, as a minimum monthly regulatory requirement.

**Figure 3 - Modeled with CalSim II: Average Delta Outflow as a Percentage of Unimpaired Delta Outflow**

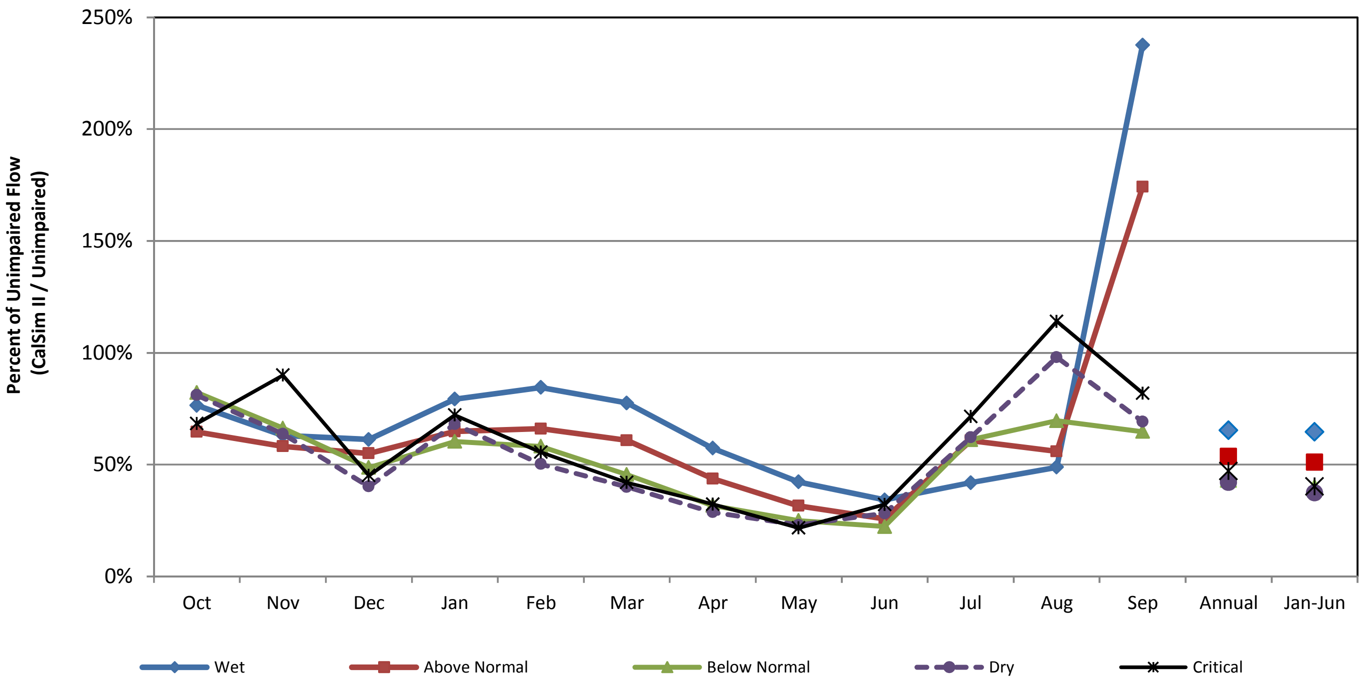



**Figure 4 - Modeled with CalSim II: Average January through June Delta Outflow as a Percentage of Unimpaired Delta Outflow**

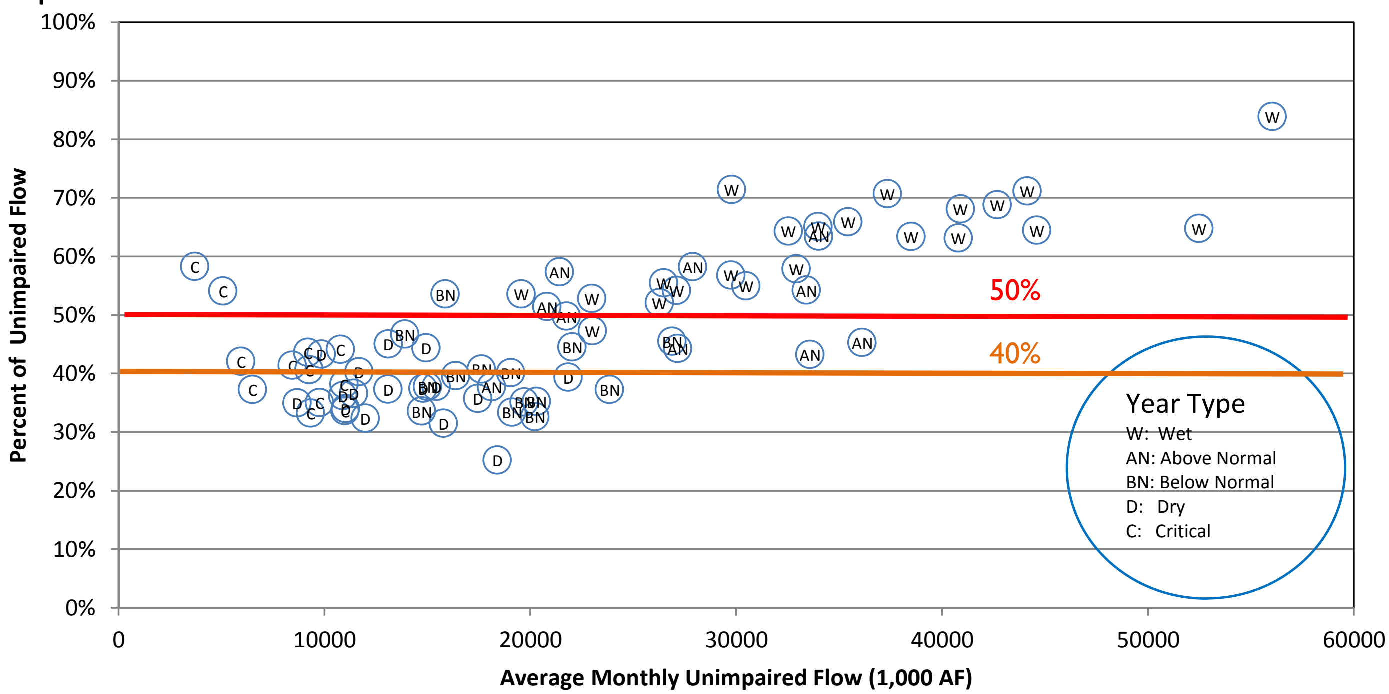



**Table 2 - Modeled with CalSim II: Average January through June Delta Outflow as a Percentage of Unimpaired Delta Outflow**

| Wet | Above Normal | Below Normal | Dry | Critical | All Years |
|---|---|---|---|---|---|
| 65% | 51% | 40% | 37% | 40% | 53% |

## Sacramento River Basin Delta Inflow

Figure 5 is a plot of historical Sacramento River Basin Delta inflows as percentages of unimpaired flows, averaged for the following periods:

- 1930-1943: Pre-Shasta Reservoir
- 1944-1955: Pre-Folsom Reservoir
- 1956-1968: Pre-Oroville Reservoir
- 1969-2003: Post Sacramento Basin Project Reservoirs
- All years: 1930-2003

Although there were hydrologic fluctuations and varying regulatory requirements during the post-1944 period, the January through June averages of Delta inflows as percentages of unimpaired flows into the Delta from the Sacramento River have changed minimally during this almost 70-year period.

During the period from 1969 through 2003, hydrologic conditions varied significantly and regulatory standards became more stringent. The percentage of historical Sacramento River Delta inflows to unimpaired flows for the July through October period have increased through time due to increases in flow and salinity requirements and Delta exports. Figure 6 is a plot showing, for the 1969-2003 period, average January through June historical Sacramento River Basin flows to the Delta as percentage of unimpaired flows for each year. Each data point is labeled with the year type. The average percentages of Sacramento River Delta inflows to unimpaired flows for each water year type are listed in Table 3. In wetter years, Sacramento River inflows tend to be higher percentage of unimpaired outflows, while in drier years these percentage tend to be lower.

Figure 7 contains a chart showing monthly average Sacramento River Basin Delta inflows as percentages of unimpaired flows by water year type for the 1922-2003 period. Based on the CalSim II baseline, the average percentage of Sacramento River Basin Delta inflows to unimpaired flows for the January through June period is 78%; the average of these percentages for critical years is 67%. Although Sacramento River Basin inflows to the Delta are a higher percentage of unimpaired flows (69%) than are Delta outflows (50%), the percentage of Delta outflow to unimpaired flows is applied as a minimum flow requirement for Sacramento River inflows to the Delta for this analysis. This assumption will estimate less adverse effects to the Sacramento River Basin than would occur with a 78% minimum flow requirement.

**Figure 5 - Average Historical Sacramento Basin Delta inflow as a Percentage of Unimpaired Sacramento Basin Delta Inflow**

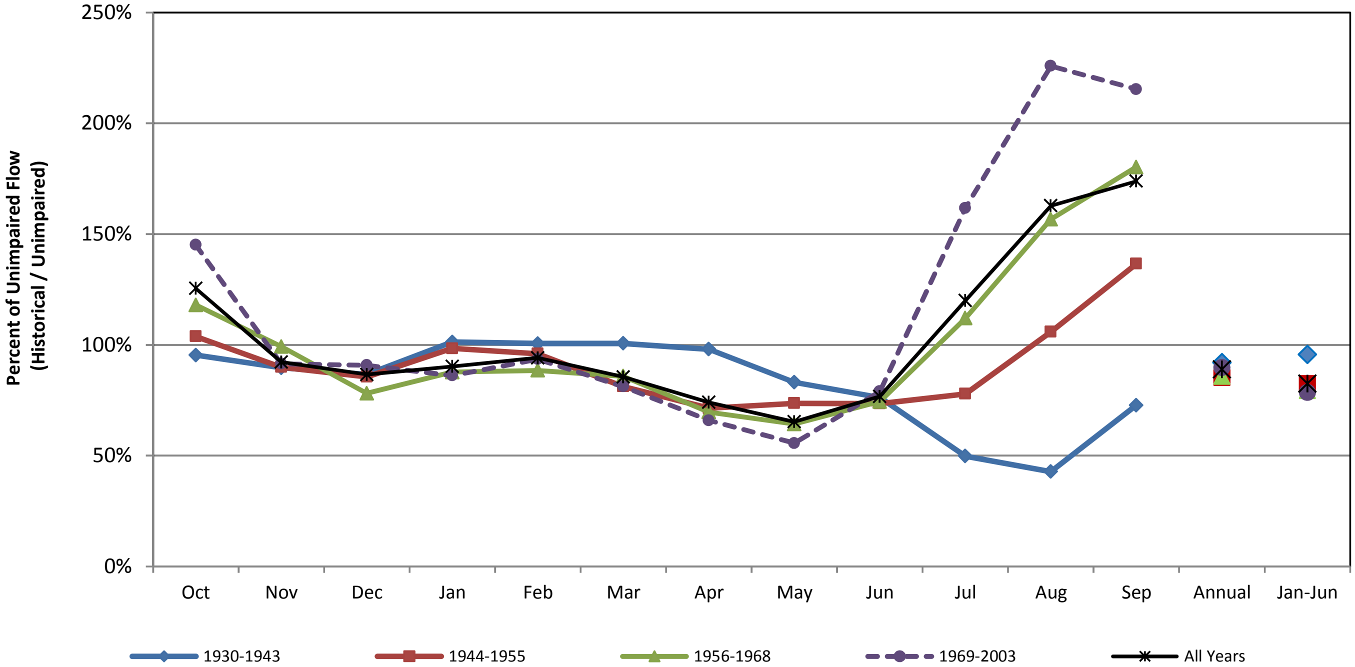



**Figure 6 - Historical 1969-2003 Average January through June Sacramento Basin Delta inflow as a Percentage of Unimpaired Sacramento Basin Delta Inflow**

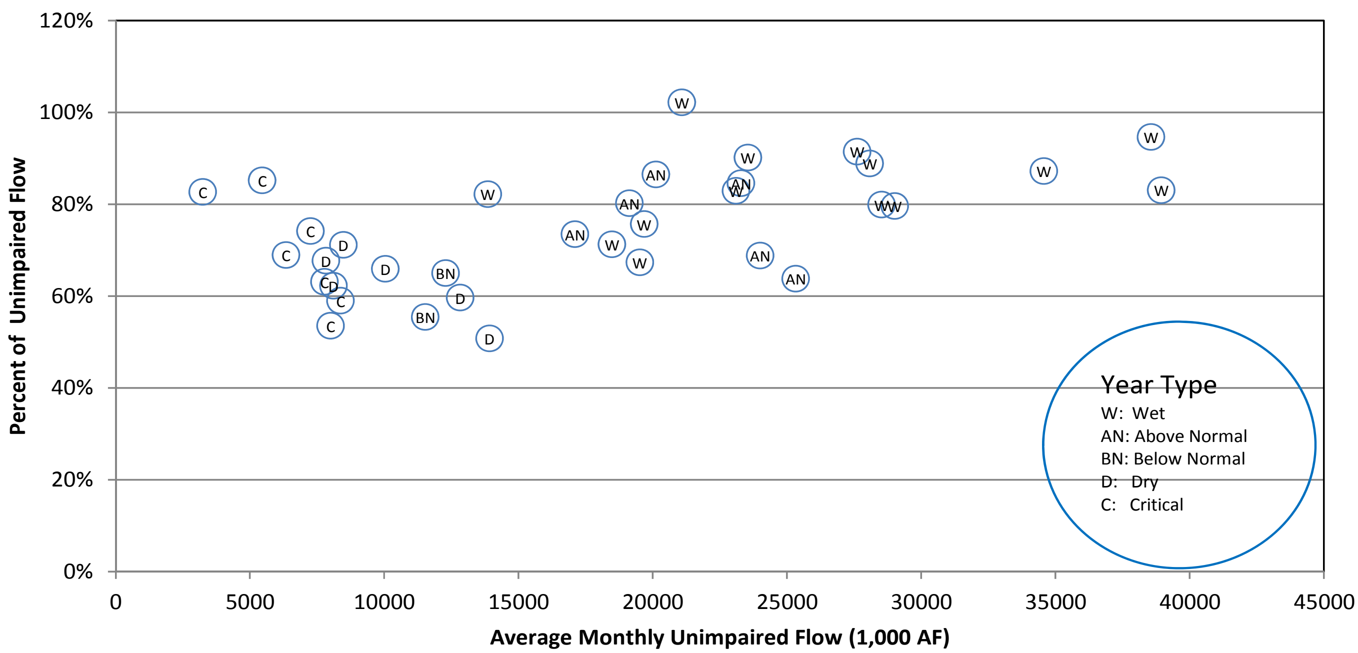



**Table 3 - Historical 1969-2003 Average January through June Historical Sacramento Basin Delta Inflow as a Percentage of Unimpaired Sacramento Basin Delta Inflow by SRI Water Year Type**

| Wet | Above Normal | Below Normal | Dry | Critical | All Years |
|---|---|---|---|---|---|
| 85% | 76% | 60% | 62% | 67% | 78% |

**Figure 7 - Modeled with CalSim II: Average Sacramento Basin Delta Inflow as a Percentage of Unimpaired Sacramento Basin Delta Inflow**

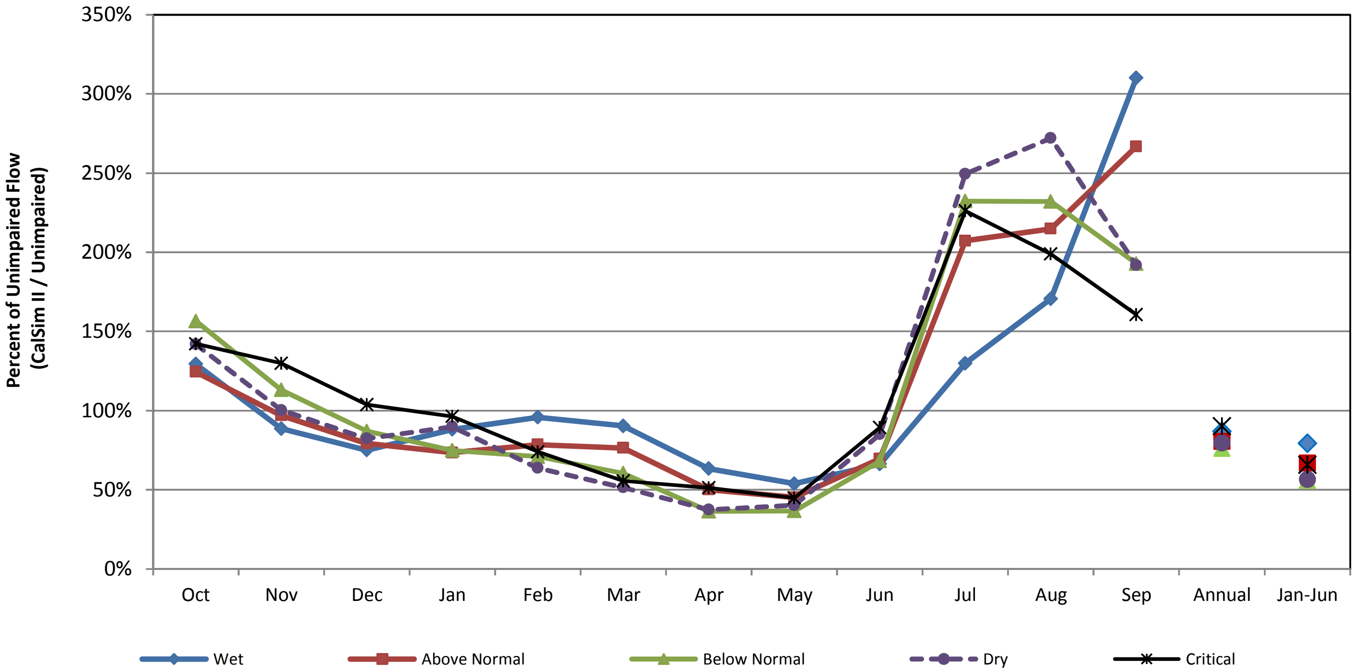



**Table 4 - Modeled with CalSim II: Average January through June Sacramento Basin Delta Inflow as a Percentage of Unimpaired Sacramento Basin Delta Inflow**

| Wet | Above Normal | Below Normal | Dry | Critical | All Years |
|---|---|---|---|---|---|
| 79% | 67% | 56% | 56% | 65% | 69% |

# MODELING ASSUMPTIONS AND LIMITATIONS

The primary analytical tool used for this effort is the latest publically available version of the CalSim II model. The CalSim II model simulation used to support the State Water Project Delivery Reliability Report (SWP DRR) is the best available modeling tool and latest public release of the model. The DRAFT Technical Addendum to SWP DRR 2011, titled January 2012 of the SWP DRR, describes the CalSim II modeling assumptions. For this analysis, CalSim II was used to assess changes in CVP / SWP storage, river flows, water deliveries, and Delta conditions. The SWP DRR may be found at the following web location: http://baydeltaoffice.water.ca.gov/swpreliability/2011DraftDRR012612.pdf.

The Delta outflow requirements based on 50% and 40% of unimpaired flows described above were inputted into the CalSim II Existing Conditions model simulation to develop two new model simulations, which estimate how the system would operate with such Delta outflow requirements. Two CalSim II model simulations were developed to perform this analysis: one with a 50% of unimpaired Delta outflow requirement and a 50% of unimpaired Sacramento River flow requirement from January through June, and the other with a 40% of unimpaired Delta outflow requirement and a 40% of unimpaired Sacramento River flow requirement from January through June. These two model simulations were then compared to Existing Conditions to estimate the changes to the water system that would occur with the new Delta outflow requirements. The applicable Delta outflow requirement for each simulation then was applied as an average monthly net Delta outflow requirement, and the Sacramento River Basin requirement was applied as a minimum requirement for the sum of Sacramento River flow at Freeport plus the Yolo Bypass inflow to the Delta.

The SWRCB's 2010 Delta flow criteria report suggests that its proposed criteria that are stated in percentages of unimpaired flows could be implemented as 14-day running averages. The CalSim II model, however, simulates on a monthly time step and does not provide daily or hourly results and, therefore, simplifies the hydrologic diversity that exists in reality. Accordingly, when using the CalSim II model – which is the best available model -- it is difficult to predict how requirements that are based on a percentage of the unimpaired flows would be implemented or operated on 14-day average basis. Modeling using the CalSim II model probably understates the real impacts of implementing the proposed Delta outflow and Sacramento River flow requirements as percentage of unimpaired flows on a time-step less than one month, as suggested by the proposed Delta flow criteria in the SWRCB's 2010 report.

In addition, the CalSim II model primarily simulates operations of the CVP and SWP Systems. The SWRCB's 2010 Delta flow criteria report suggests that the SWRCB would seek to spread the impacts of implementing the proposed Delta outflow and streamflow requirements over all upstream users, but no integrated model with this capability currently exists. Therefore, the CalSim II model for the SWP/CVP was used for this analysis as a surrogate for the kinds of impacts that may be observed if Delta outflow and Sacramento River flow requirements based on percentage of unimpaired flows were implemented as minimum outflow and flow requirements.

The water supply impacts that would result from 50% and 40% of unimpaired flow requirements for Delta outflow and Sacramento River flow would be extreme and would go far beyond what CalSim II is designed to evaluate.  If these requirements were implemented, then SWP and CVP reservoirs would be at the "dead pool" levels by the end of summer in many years, CVP and SWP settlement contracts would be violated due to the lack of adequate water supplies, and existing temperature and water quality standards could not be met much of the time due to exhaustion of water supplies in the reservoirs.  None of these events are consistent with how the CVP and SWP actually would be operated.  For this reason, to more accurately model the effects of such requirements, a new in-basin depletion analysis would need to be constructed, and this analysis necessarily would have to simulate the additional reductions in water supplies that would result from implementation of such requirements.  The CalSim II modeling described in this evaluation was used to evaluate the order of magnitude of water system impacts.  However, because of these limitations in the CalSim II model, the results discussed in this evaluation are underestimates of the impacts that actually would occur from implementing these Delta outflow and Sacramento River flow requirements.

# OBSERVATIONS

When a 50% of unimpaired Delta outflow requirement and a 50% of unimpaired Sacramento River Basin inflow to the Delta requirement from January through June are imposed on the Existing Conditions scenario, the average annual Delta outflow increases by 1,057,000 AF. The model results show that the 50% of unimpaired flow requirement for Sacramento River inflows to the Delta normally would not govern CVP/SWP operations because the more onerous Delta outflow requirement would control in all but 3 monthly time steps in the 82-year simulation. The model results indicate that, to meet a Delta outflow requirement based on 50% of unimpaired flows, Sacramento River Basin inflows to the Delta would increase by an average of 331,000 AF annually, Delta exports would decrease annually by 703,000 AF, and other Delta diversions (including the North Bay Aqueduct) would decrease by 23,000 AF annually. The CalSim II modeling estimated that the increased Sacramento River Basin inflows to the Delta of 331,000 AF would require increased imports from the Trinity River Basin of 91,000 AF, increased Sacramento River Basin groundwater pumping of an annual average of 248,000 AF, and other average annual changes of 8,000 AF. Figure 8 shows these estimated average annual flow changes by water year type.

When a 40% of unimpaired Delta outflow requirement and a 40% of unimpaired Sacramento River Basin to Delta flow requirement from January through June are imposed on the Existing Conditions scenario, the average annual Delta outflow increases by 484,000 AF. The model results show that the 40% of unimpaired flow requirement for Sacramento River inflows to the Delta normally would not govern CVP/SWP operations because the more onerous Delta outflow requirement would control in all months of the simulation. The model results indicate that, o meet a Delta outflow requirement based on 40% of unimpaired flows, Sacramento River Basin inflows to the Delta would increase an average of 136,000 AF annually, Delta exports would decrease annually by 333,000 AF, and other Delta diversions (including the North Bay Aqueduct) would decrease by 15,000 AF annually. The CalSim II modeling estimated that the increased Sacramento River Basin inflows to the Delta of 136,000 AF would require increased imports from the Trinity River Basin by 32,000 AF, increased Sacramento River Basin groundwater pumping of an annual average of 99,000 AF, and other changes of 7,000 AF. Figure 9 shows these estimated average annual flow changes by water year type.

**Imports from the Trinity River Basin**

The requirements of 50% and 40% of unimpaired flows are outside the operational parameters that CalSim II was designed to model. The CalSim II logic that balances Trinity and Shasta Reservoir storage amounts properly for Existing Conditions therefore may not be suitable for modeling the operations that would be necessary to satisfy these outflow and flow requirements. In particular, desired increases in releases from Trinity Reservoir to the Trinity River may be inconsistent with the CalSim II modeled operations that would be triggered by these requirements based on 50% and 40% of unimpaired flows. Additional modeling logic that isolates Trinity operations from the Sacramento River Basin operations therefore may need to be developed. Because imports from the Trinity River Basin actually might not increase as much as is indicated by the CalSim II modeling done for this evaluation, the model results described in this report probably underestimate the impacts within the Sacramento River Basin that actually would occur with implementation of these requirements.

**Figure 8 - Annual Average Changes in Flow by Water Year Type**
**50% Unimpaired Flow Requirement**

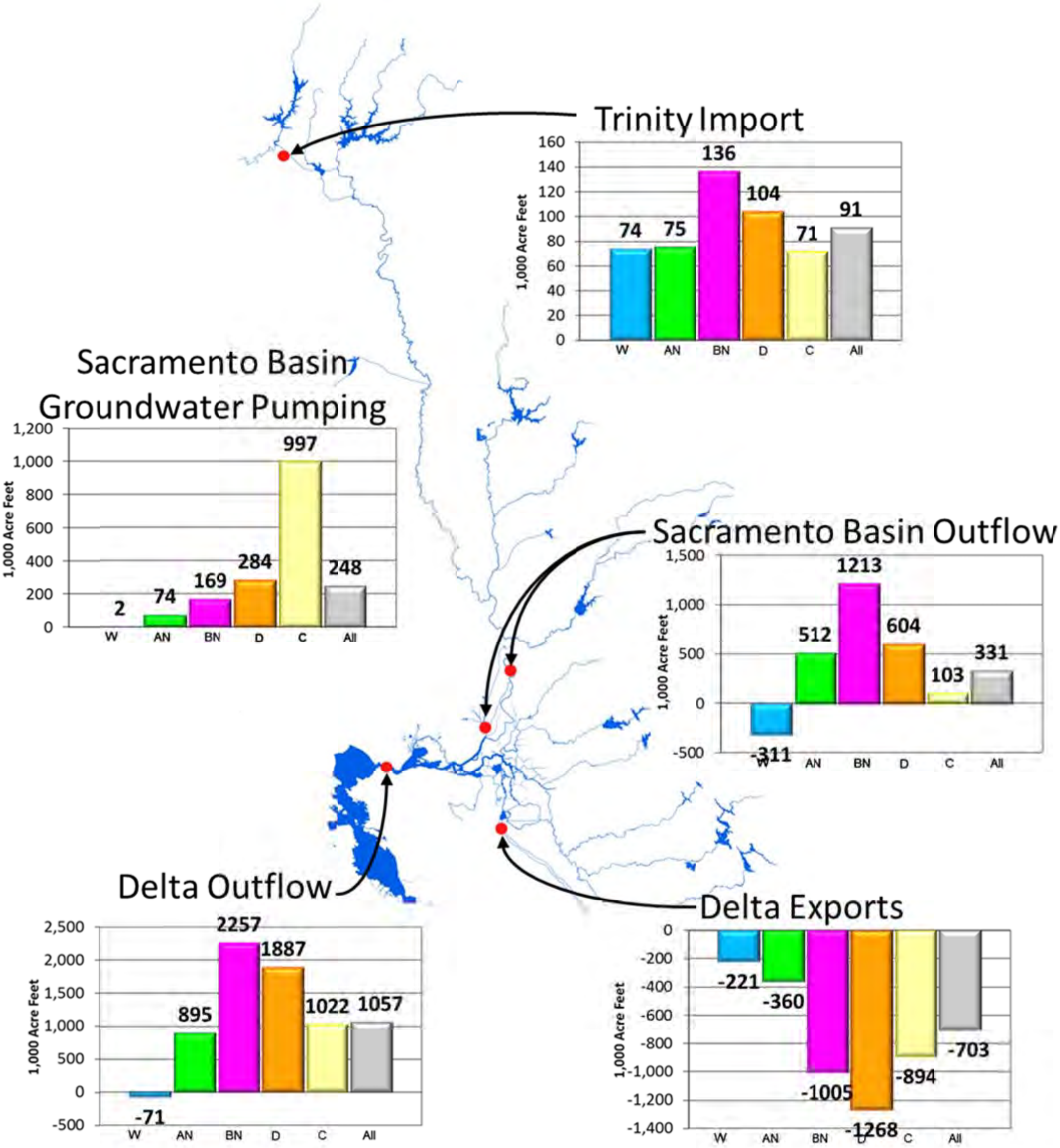
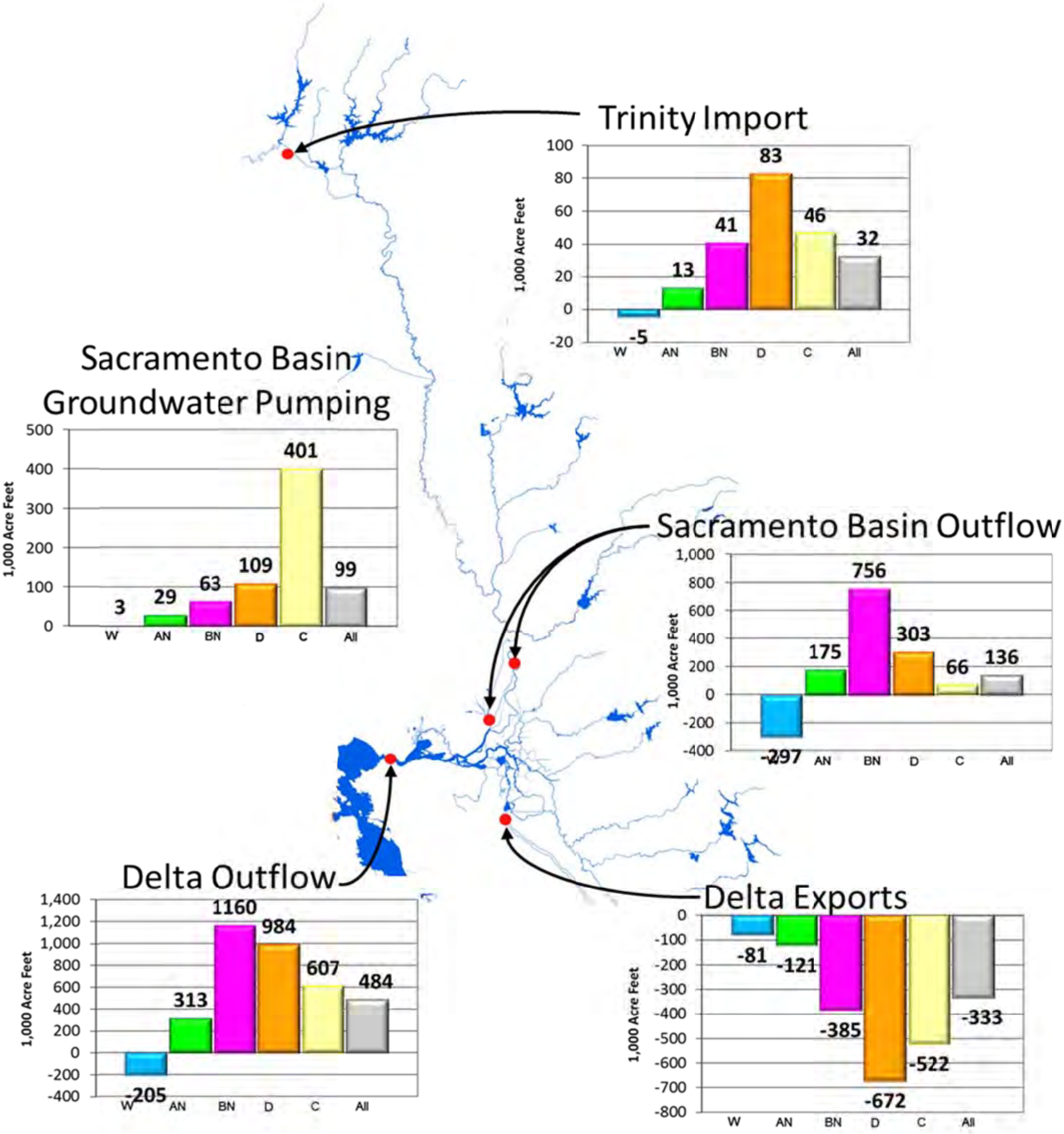


**Figure 9 - Annual Average Changes in Flow by Water Year Type**
**40% Unimpaired Flow Requirement**



**Groundwater and land fallowing**

As noted above, water supply impacts of the requirements that are 50% and 40% of unimpaired flows would exceed what the existing CalSim II model can readily assess. For example, when a CalSim II modeling scenario does not have enough water to meet in-basin demands, the model simply assumes that groundwater in the Sacramento Valley will be pumped to make up the shortage. However, the groundwater pumping that would be necessary to make up for the water supply losses to water users in the Sacramento River Basin with implementation of requirements that are 50% and 40% of unimpaired flows would not be physically possible or sustainable. Figures 10 and 11 show the added groundwater pumping that would be needed to meet in-basin demands that would be necessary to make up for the losses in surface water supplies that would occur with implementation of these requirements.

Although the CalSim II modeling for these requirements assumes that groundwater pumping would increase as necessary to make up for all losses in surface-water supplies in the Sacramento River Basin, in reality this would not be possible, so, in reality, there probably would be reductions in total crop acreage and wildlife refuge water supplies. Also, any increases in actual groundwater pumping probably would result in lower groundwater levels and increases in groundwater recharge (similar in magnitude to the increases in pumping). These increases in recharge would result in decreases in stream flows, which would cause additional needs for groundwater pumping, reservoir releases, and crop fallowing. Decreases in groundwater levels also probably would cause adverse impacts to major surface water systems and ephemeral stream habitat (by inducing greater recharge through streambeds) and to urban wells. There are a large number of factors affecting the interrelationships between groundwater levels and pumping, stream-groundwater interactions, deep percolation of applied water, percolation of precipitation, and natural recharge, all of which make it difficult to speculate how much additional pumping, recharge, and fallowing would occur if these requirements were implemented.

**Figure 10 – Required Groundwater Pumping Due to 50% Unimpaired Flow Requirement**

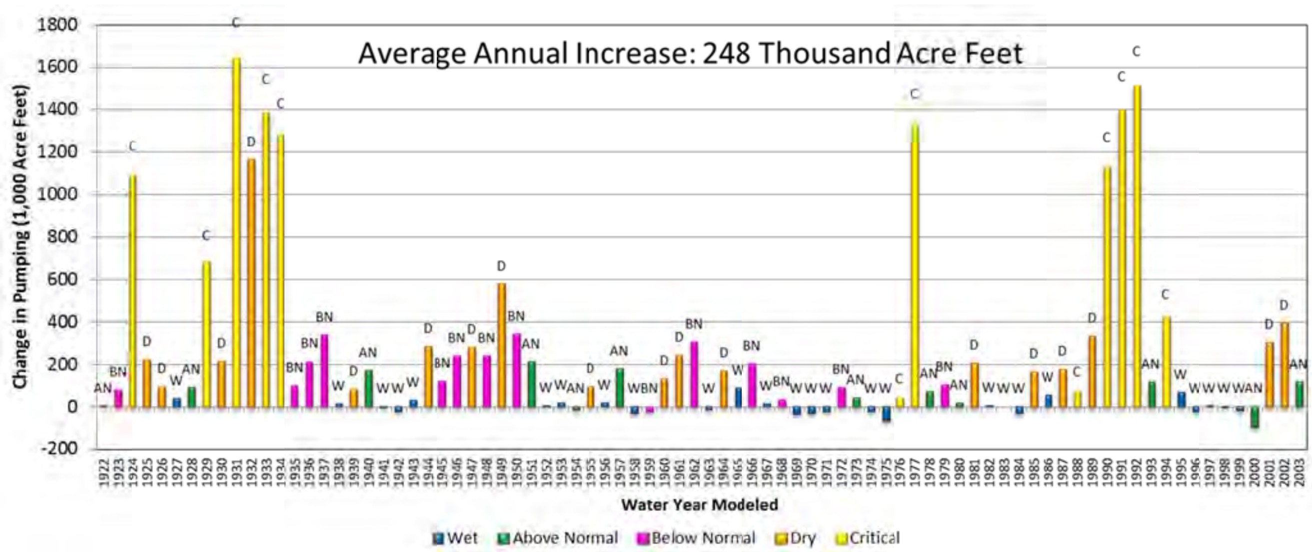
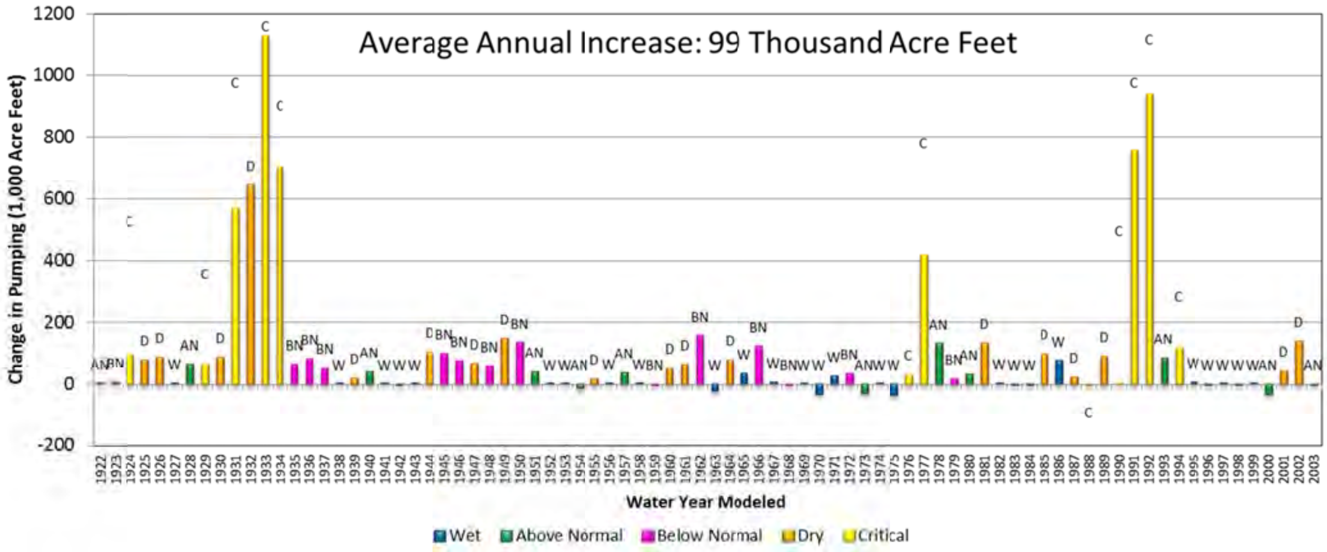


**Figure 11 – Required Groundwater Pumping Due to 40% Unimpaired Flow Requirement**




**Project Reservoir Storage**

Figure 12 and Figure 13 show the expected CVP and SWP reservoir levels that would occur at the end of September with implementation of requirements of 50% and 40% of unimpaired flows. The 50% of unimpaired flow requirements would cause Trinity, Shasta and Folsom Reservoirs to be at the dead pools (effectively empty) by the end of September in 20% of all years, and Oroville Reservoir to be at its minimum pool in 40% of all years. In contrast, under current operating rules, such dead pool levels would occur only rarely. With implementation of the 50% of unimpaired flow requirements, average carryover storage reductions for the major project reservoirs would be :

- Trinity Reservoir: - 460,000 AF
- Shasta Reservoir: - 960,000 AF
- Oroville Reservoir: - 620,000 AF
- Folsom Reservoir: - 150,000 AF

The total reduction in upstream carryover project storage that would be caused by implementing a 50% of unimpaired flow requirement would be about 2.2 million AF, and the carryover reduction would be even greater in drier years. These reductions in carryover storage, coupled with substantially increased groundwater pumping, would result in water supply deficits in the Sacramento Valley that would be greater than 2 million AF in below normal, dry, and critical years. Under these conditions, the CVP and SWP reservoir storage levels required by in the National Marine Fisheries Services' 2009 salmon Biological Opinion (BO) could not be maintained. In addition, the cold-water pools in these reservoirs that are necessary to meet temperature conditions downstream for salmon survival and reproduction would be completely depleted in 20% of years, and would be greatly reduced in other years. These depletions and reductions would make it virtually impossible for CVP and SWP operations to achieve acceptable temperature requirements in the rivers downstream of these reservoirs. With implementation of these requirements, maintaining acceptable storage levels in these reservoirs throughout summer months may not be possible, even with severe reductions in agricultural diversions. Reducing reservoir releases by 2 million AF from July through September would result in violations of applicable instream flow requirements and would make it difficult or impossible to meet applicable instream temperature requirements.

Implementation of the 40% of unimpaired flow requirements would result in Trinity, Shasta, Folsom Reservoirs being at their dead pools (effectively empty) by the end of September in roughly 10% of all years, and in Oroville Reservoir being at its minimum pool in 30% of all years. With implementation of the 40% of unimpaired flow requirements, average carryover storage reductions for the major project reservoirs would be:

- Trinity Reservoir: - 200,000 AF
- Shasta Reservoir: - 423,000 AF
- Oroville Reservoir: - 390,000 AF
- Folsom Reservoir: - 79,000 AF

The total reduction in upstream carryover project storage that would occur with implementation of the 40% of unimpaired flow requirement would be about 1.1 million AF. Although such reservoir deficits would be about half of the reservoir deficits that would occur with implement of the 50% of unimpaired flow requirement, there still would be similar types of impacts. Reducing upstream reservoir releases by 1 million AF from July through September would result in violations to the applicable instream flow requirements and would make it difficult or impossible to meet the applicable instream temperature requirements.

This extensive loss of carryover reservoir storage would have significant impacts to hydropower, recreation, lake fisheries, and downstream fisheries. During multiyear droughts, project reservoirs would be at minimum or dead pool levels throughout the drought period, which would lead to adverse conditions for fisheries in many consecutive years. Figures 14 through 17 show monthly storage in Trinity, Shasta, Oroville, and Folsom Reservoirs respectively for the 1922-2003 CalSim II simulation period for Existing Conditions and the 50% and 40% of unimpaired flow requirements. By comparing Existing Conditions storage to the 50% and 40% of unimpaired flow storage prolonged reductions in storage due to unimpaired flow requirements are noticeable, particularly in dryer conditions. These prolonged reductions in storage would result in adverse conditions that could persist for several years.

**Figure 12 - Project Reservoir Carryover Storage**
50% Unimpaired Flow Requirement

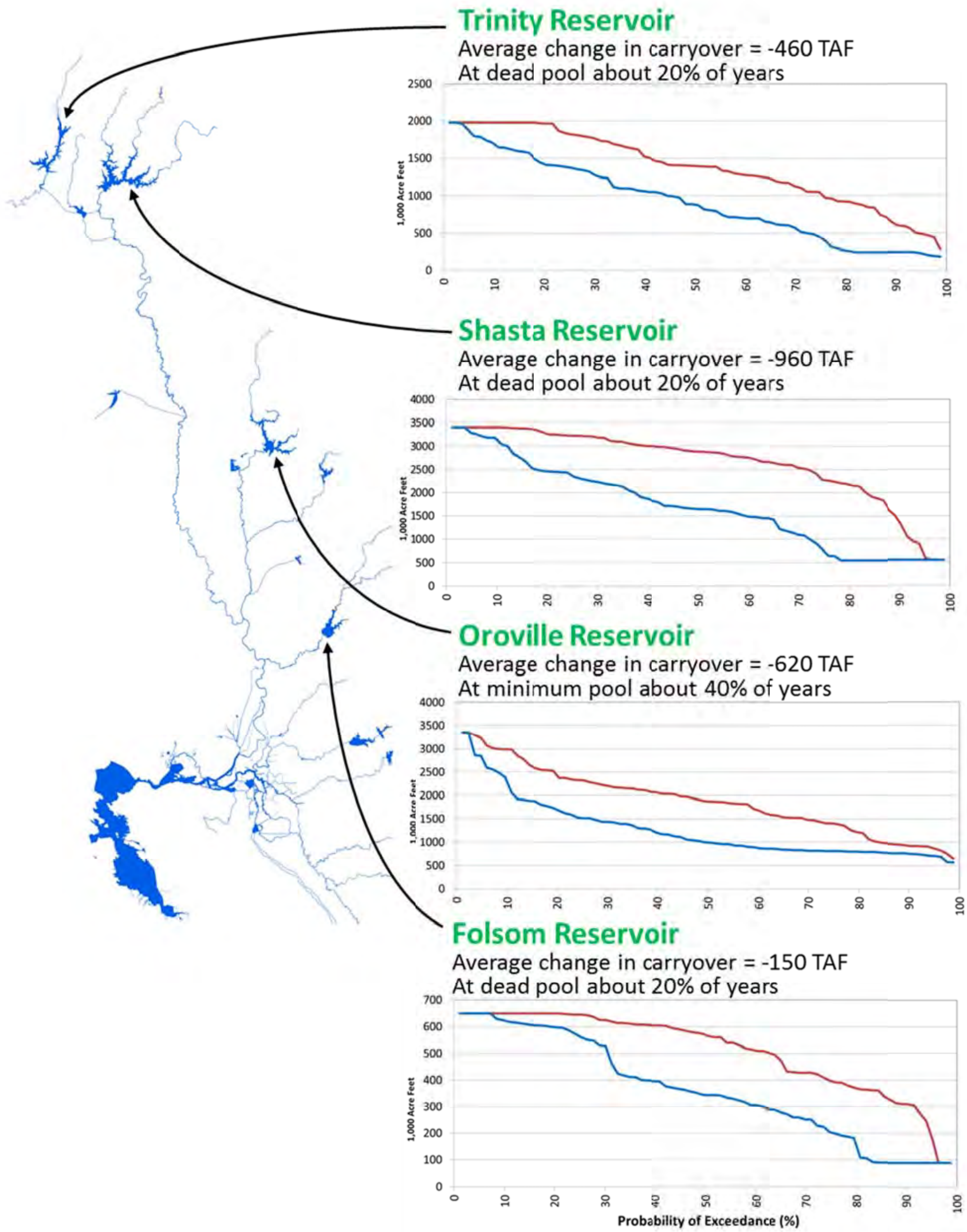
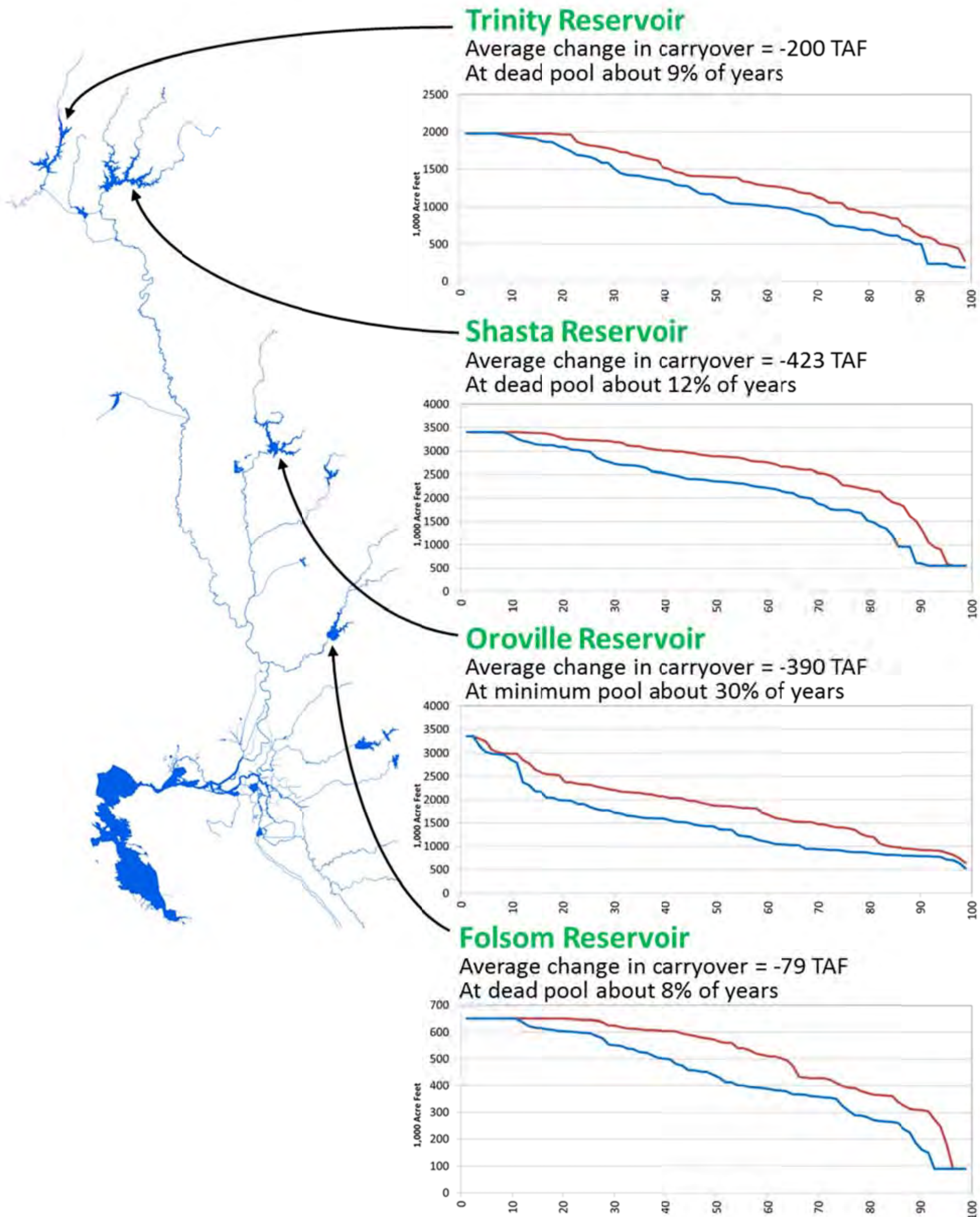
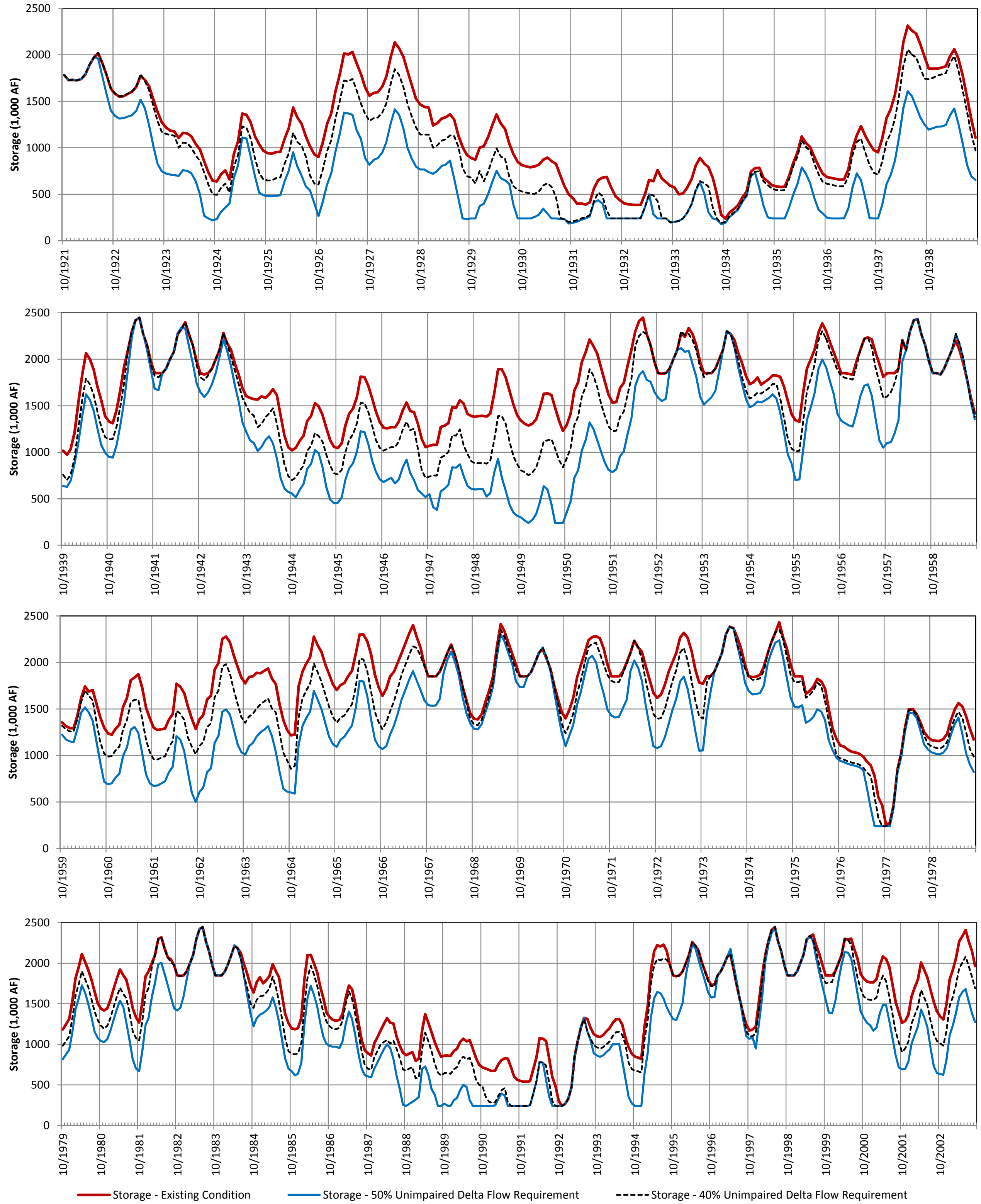


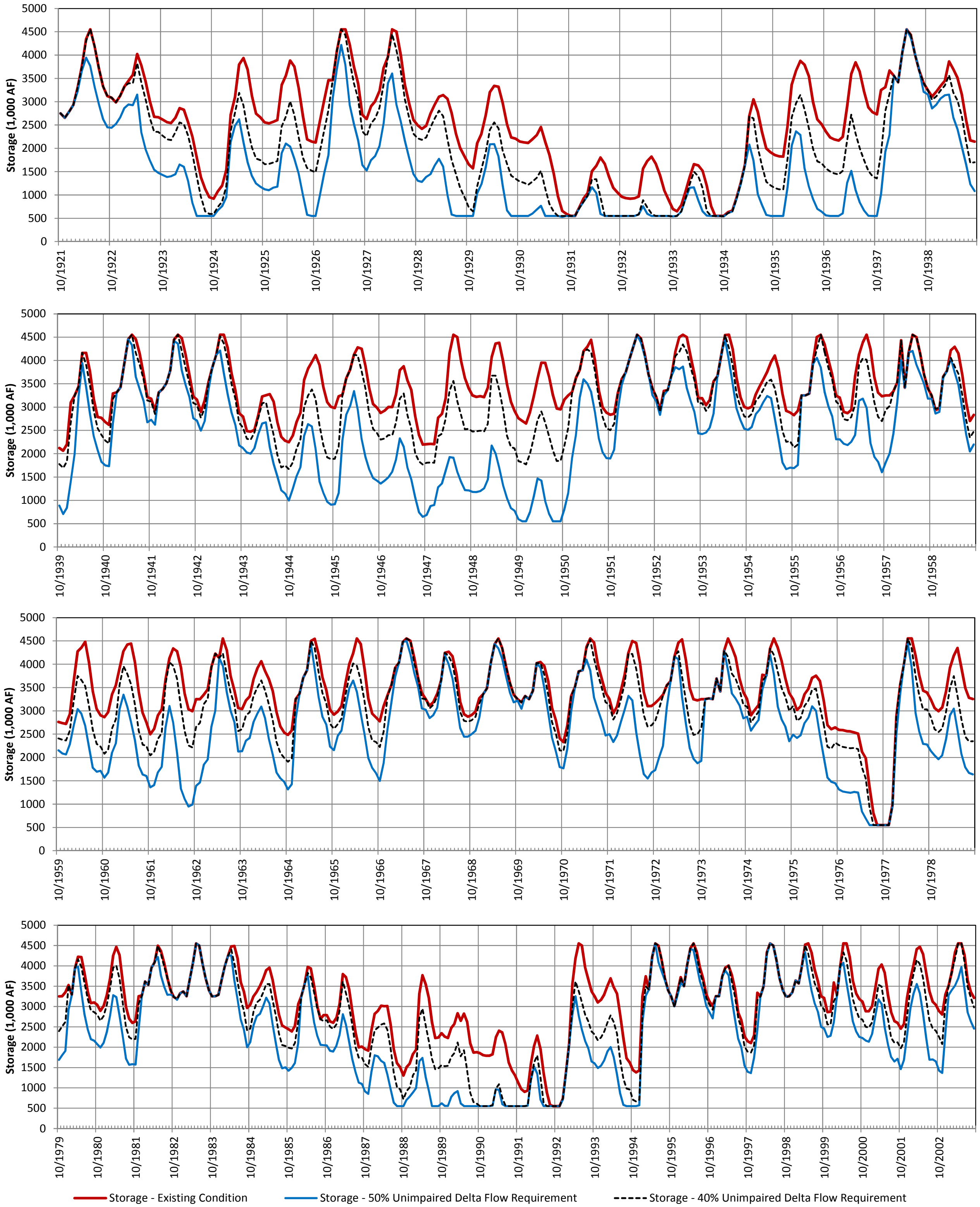
**Figure 13 - Project Reservoir Carryover Storage**
**40% Unimpaired Flow Requirement**



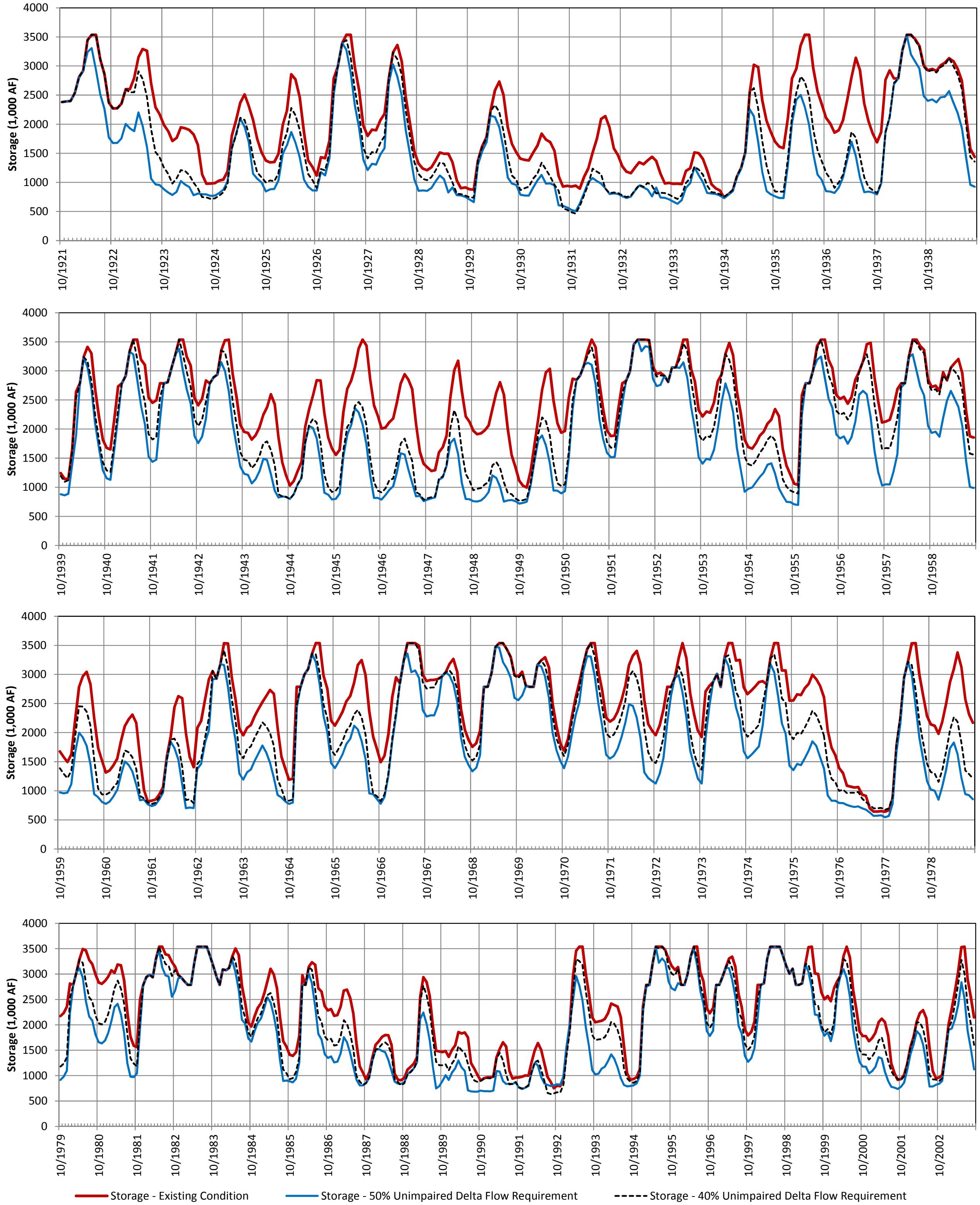
## Figure 14 - Monthly Trinity Reservoir Storage 50% and 40% Unimpaired Flow Requirement



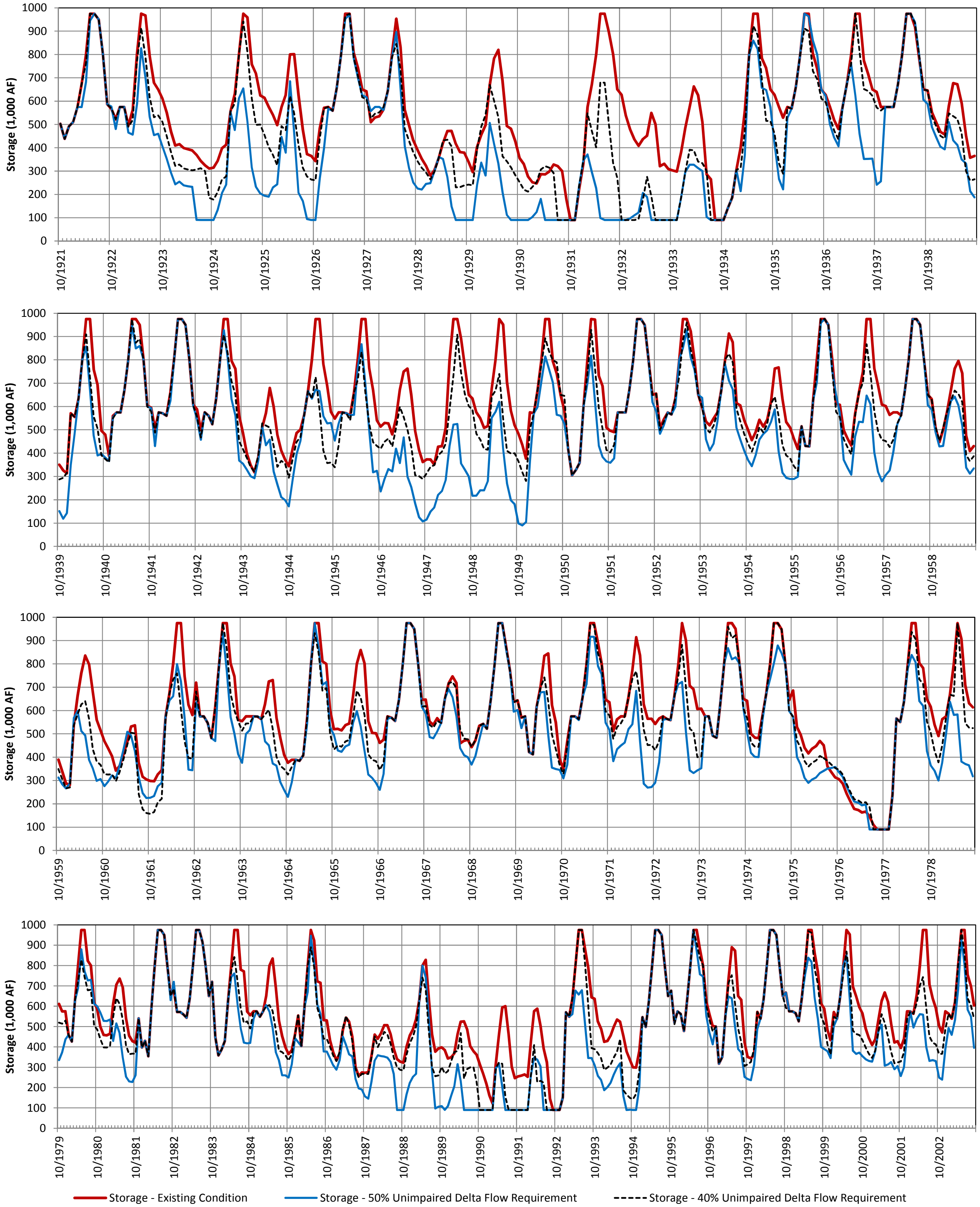
## Figure 15 - Monthly Shasta Reservoir Storage
## 50% and 40% Unimpaired Flow Requirement



## Figure 16 - Monthly Oroville Reservoir Storage
## 50% and 40% Unimpaired Flow Requirement



## Figure 17 - Monthly Folsom Reservoir Storage
## 50% and 40% Unimpaired Flow Requirement



**Changes in Flow Patterns**

Figure 18 and Figure 19 provide summaries of the kinds of changes in the monthly flow patterns that would occur in rivers below the major CVP and SWP reservoirs with implementation of the 50% and 40% of unimpaired flow requirements. These river flows would typically be higher in the months of March, April, and May, and in some Junes, but would be lower in the other months, especially the summer months. Also, as mentioned in the above discussion of impacts to project reservoirs, the changes in river flow patterns that are estimated by CalSim II are underestimates of the impacts that actually would occur. Moreover, reductions in summer river flows would be much greater if reservoir releases were decreased further, to meet reservoir carryover requirements in order to maintain cold-water pools.

These decreased flows, and the resulting increased residence times, would cause the warmer water released into rivers to increase in temperature during the summer, when air temperatures are high. Effects below Oroville and Folsom Reservoirs would be equally dramatic.

These changes in flow patterns would impact hydropower generation as well. There would be increases in generation during spring months when hydropower is already abundant, and there would be decreases in generation during summer months when the State's power demand is greatest.

**Figure 18 - Changes in Key River Flow**
**50% Unimpaired Flow Requirement**

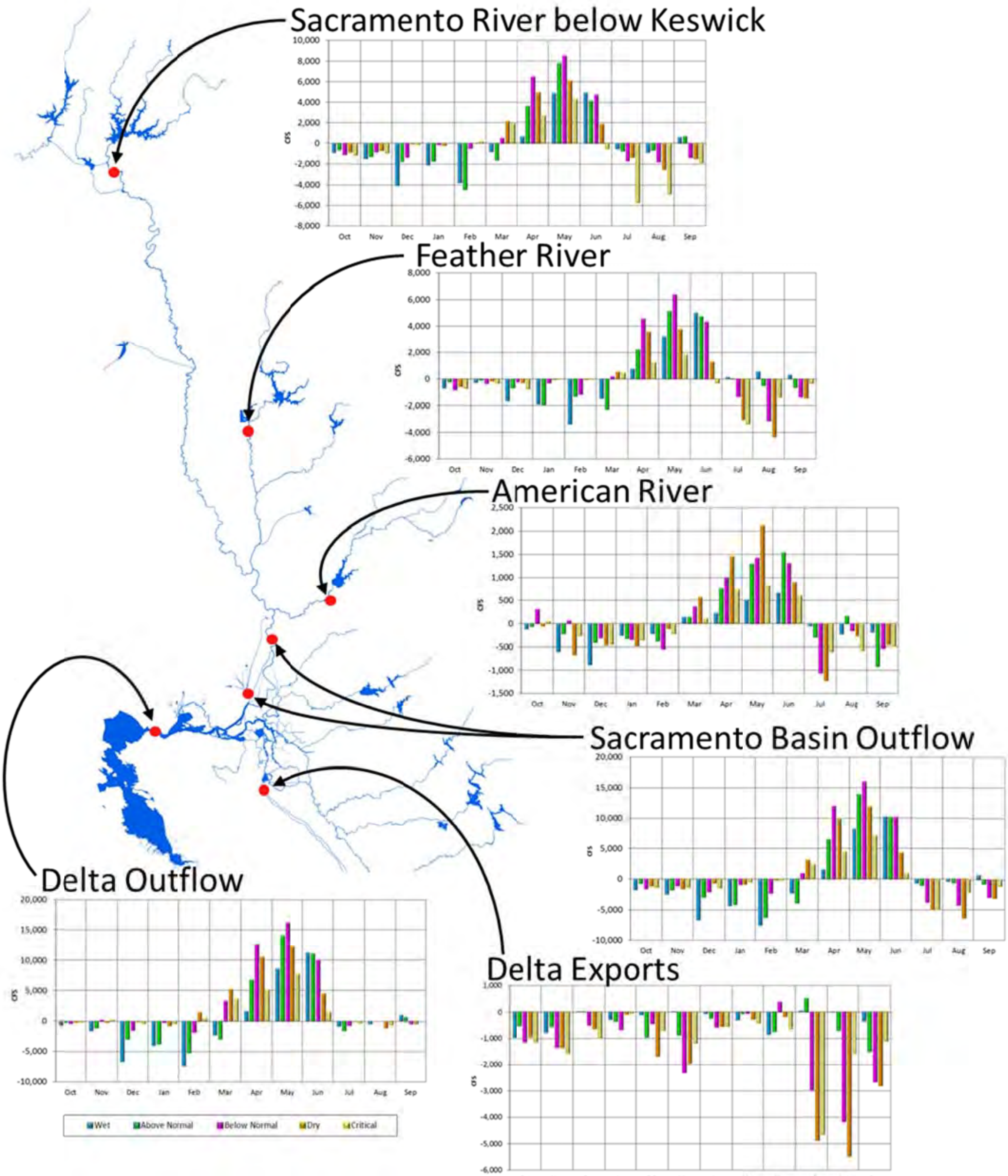
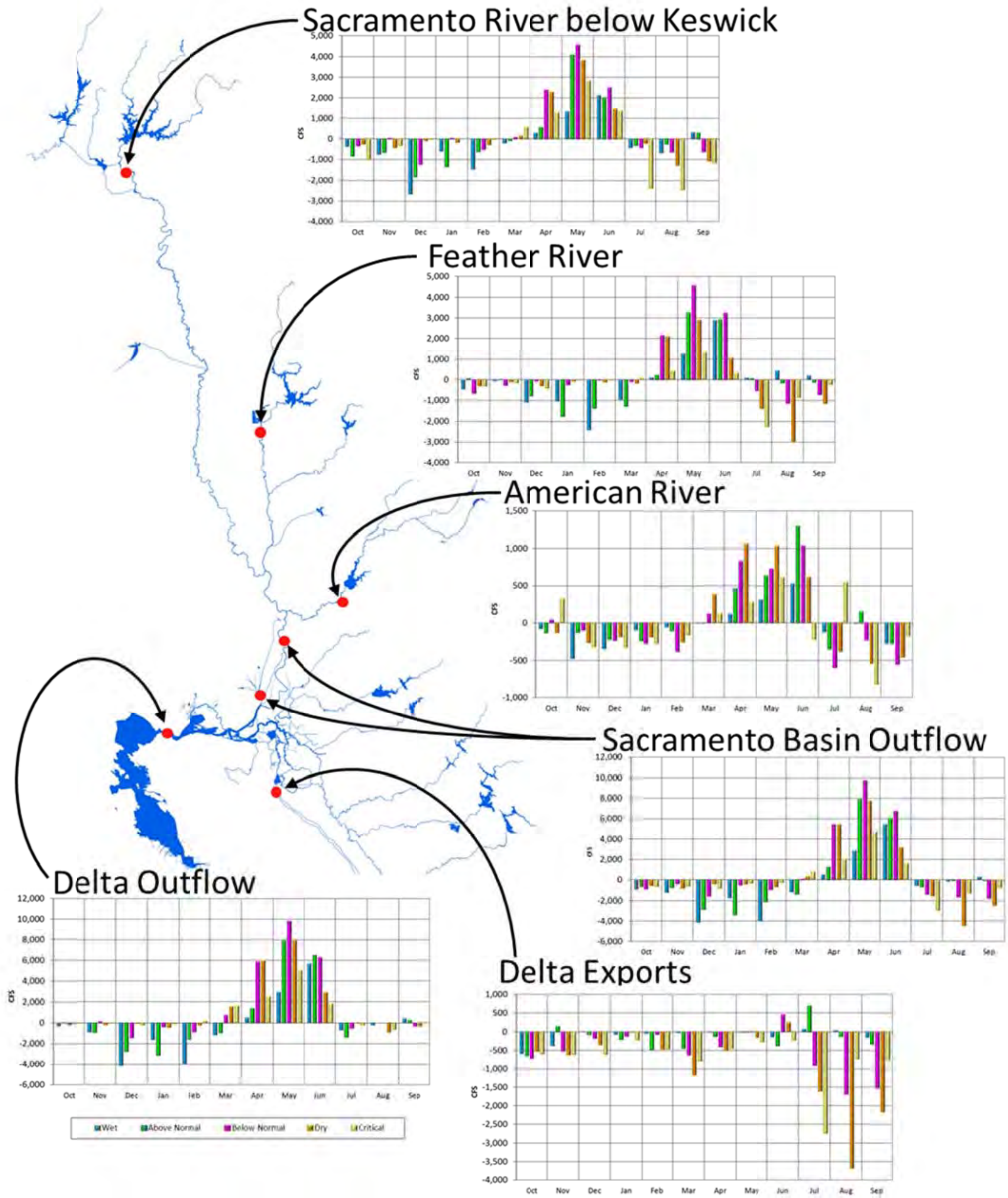


**Figure 19 - Changes in Key River Flow**
**40% Unimpaired Flow Requirement**



**Violations of Existing Instream flow, Bay-Delta Plan, and ESA Biological Opinion Requirements**

The increases in Delta outflows and Sacramento River flows that would occur during the January through June period with implementation of the 50% or 40% of unimpaired flow requirements would result in reduced river flows and Delta outflows in the July through December period. When the CalSim II model is run with these January through June percentage of unimpaired flow requirements, the model assumes that water would be released to satisfy the requirement during a specific month, even if the model then indicates that the reservoir would run out of water in the following month. For the 50% and 40% unimpaired requirement model runs, the model indicates that the CVP and SWP reservoirs would run out of water in about 20% of years. This situation would results in the inability of the CVP and SWP to comply with existing SWRCB requirements. In addition to the inability to comply with SWRCB requirements, there would be an inability to satisfy the requirements specified in the National Marine Fisheries Services' 2009 salmon biological opinion.

Figures 20 and 21 contain charts showing the monthly violations of SWRCB D-1641 requirements for the Sacramento River at Rio Vista that would occur under the 50% and 40% of unimpaired flow CalSim II model runs. In both unimpaired flow scenarios these violations would be larger than 1,000 cfs and typically would occur in drier years. There also would be a potential that D-1641 Delta water quality standards would be violated; however, this issue has not yet been analyzed.

**Figure 20 - Violations in D-1641 Flow Requirement at Rio Vista – 50% Unimpaired Flow Requirement**

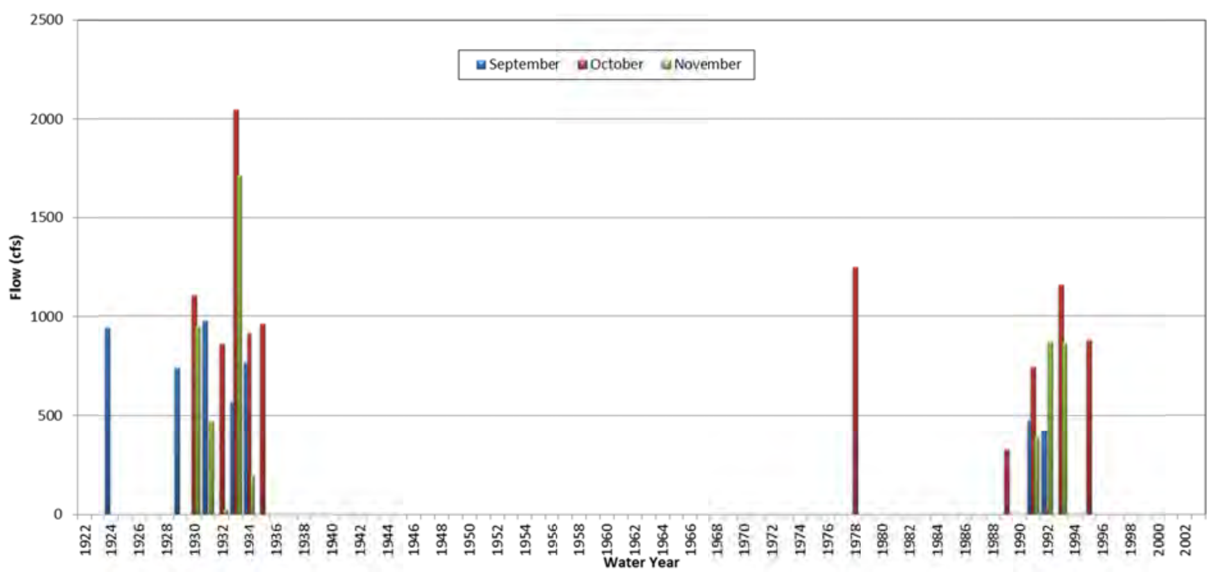
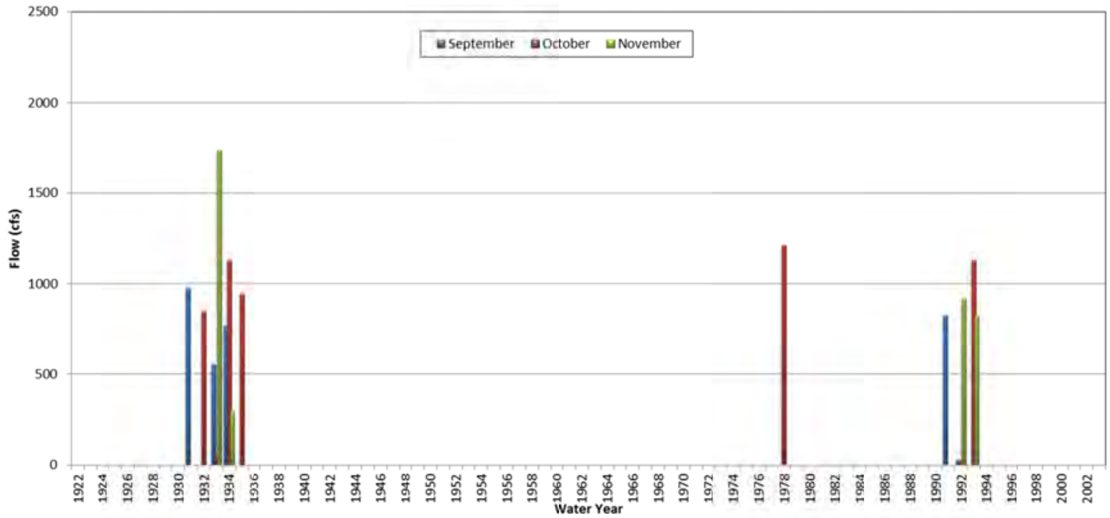


**Figure 21 - Violations in D-1641 Flow Requirement at Rio Vista – 40% Unimpaired Flow Requirement**




Figures 22 and 23 contain charts showing the monthly violations in Delta outflow requirements that would occur under the 50% and 40% of unimpaired flow CalSim II model runs. Delta outflow requirements include those contained in D-1641, the Delta smelt Biological Opinion, and the unimpaired flow requirement. In many years of the CalSim II model simulations there is not enough water to satisfy both the unimpaired flow requirement and existing Delta outflow requirements.

**Figure 22 - Shortage in Minimum Required Delta Outflow– 50% Unimpaired Flow Requirement**

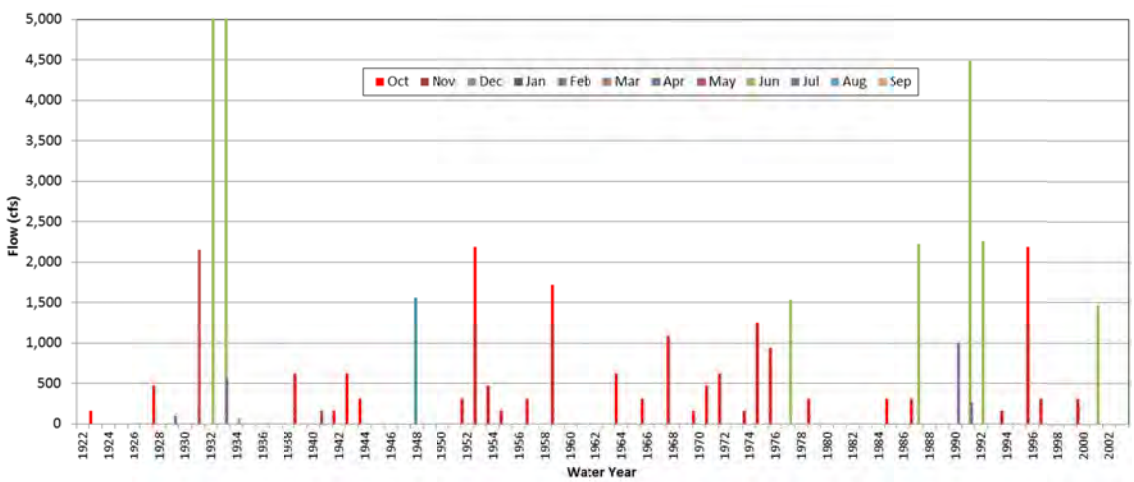
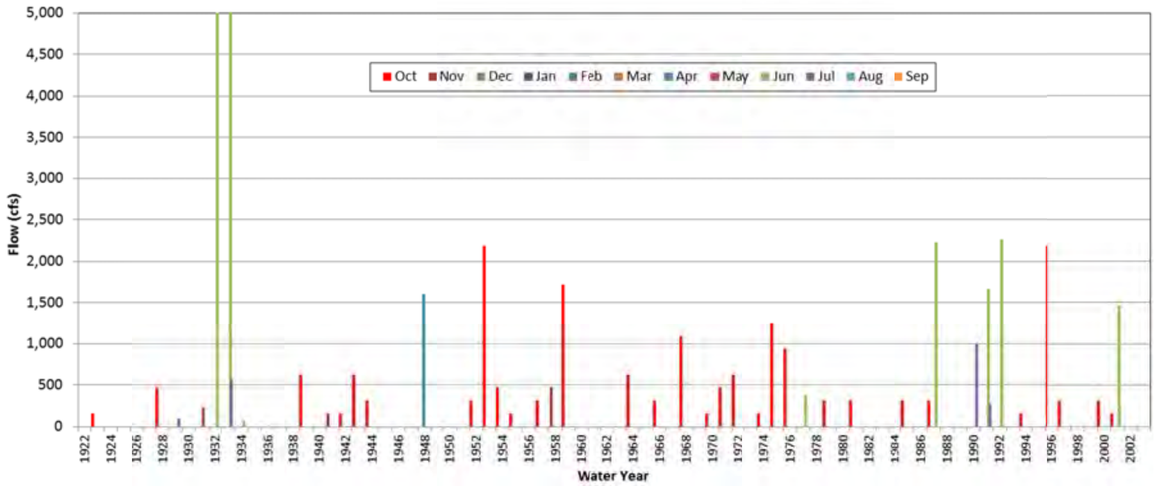
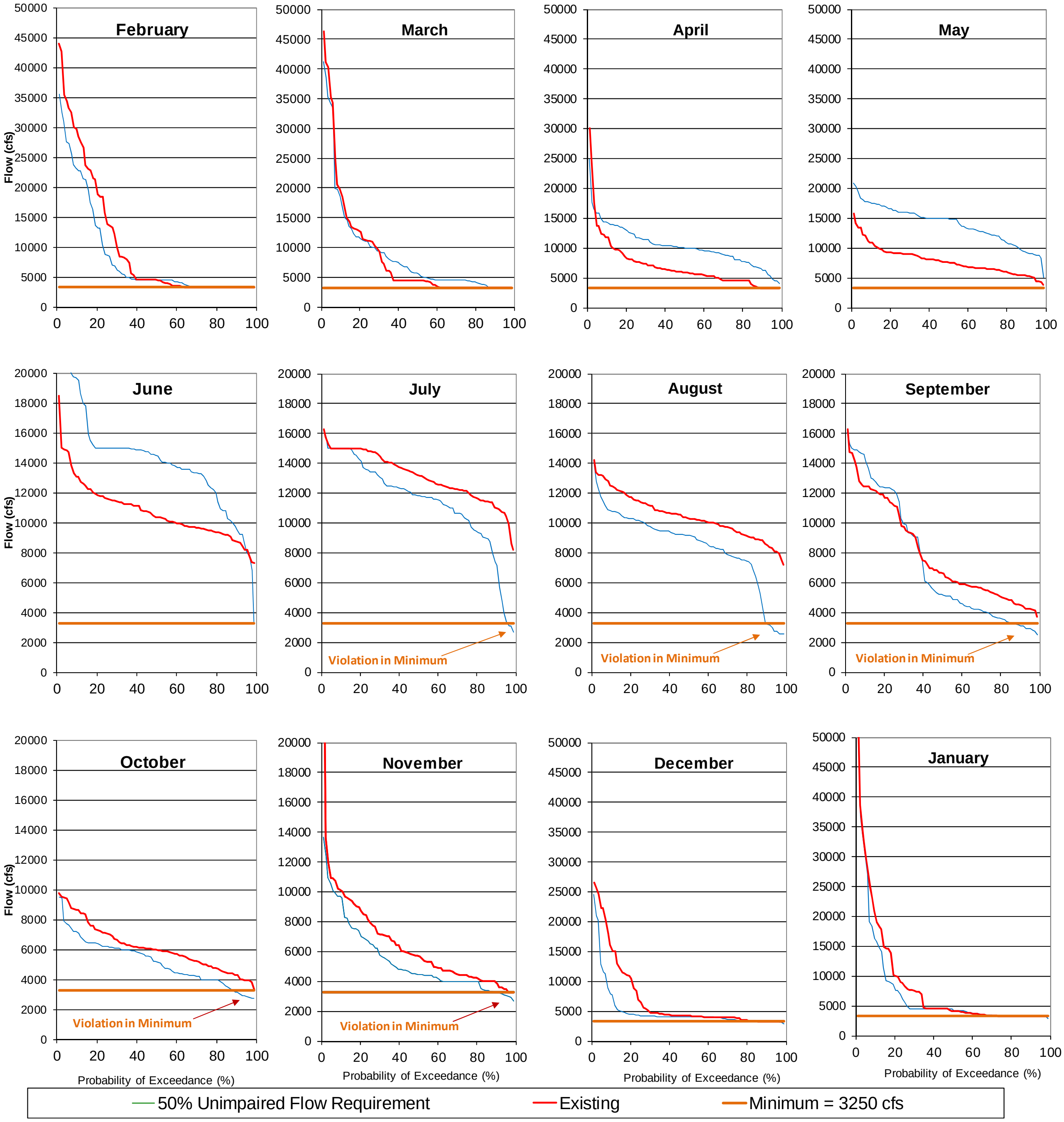


**Figure 23 - Shortage in Minimum Required Delta Outflow– 40% Unimpaired Flow Requirement**

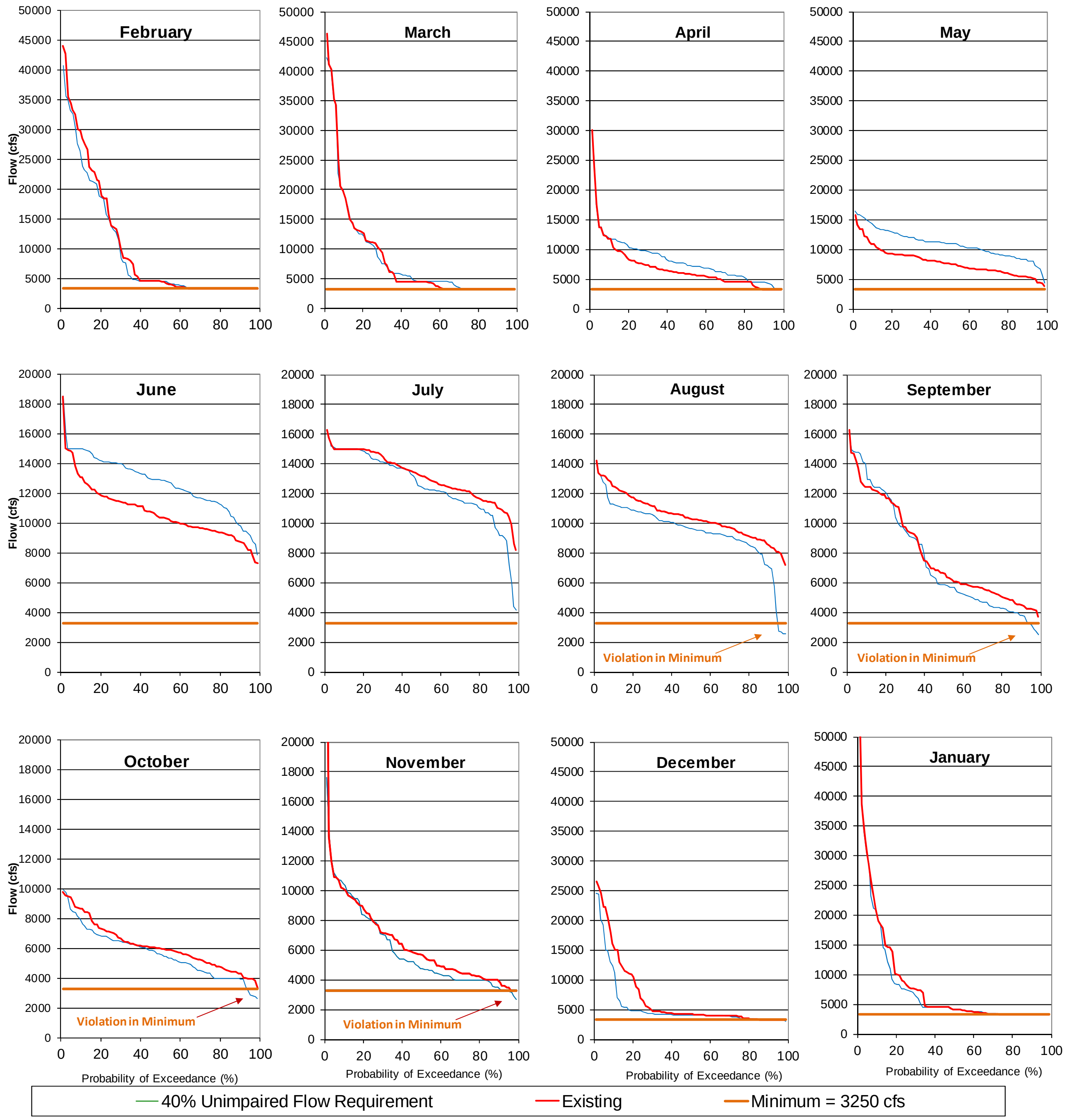



The CalSim II model assumes that flows in the Sacramento River below Keswick Dam would be reduced when Shasta Reservoir reaches dead pool. The simulation modeling the 50% and 40% of unimpaired flow requirements, indicate that, with implementation of these requirements, Sacramento River flow below Keswick Dam would drop below the minimum flow requirement of 3,250 cfs. Figures 24 and 25 contain monthly exceedance plots of the Sacramento River flows below Keswick Dam that would occur under the 50% and 40% unimpaired flow scenarios. These figures indicate that violations would occur from July through November in the 50% of unimpaired flow scenario and from August through November in the 40% of unimpaired flow scenario. If the 50% or 40% of unimpaired flow requirement model runs were adjusted to maintain required carryover reservoir storage levels, then there would need to be additional dry year reduction of about 2 million AF in the 50% scenario and 1 million AF in the 40% scenario in reservoir releases from July through September; these reductions would require Keswick releases to be reduced from July through September to levels below the applicable flow standards.

**Figure 24 – Monthly Exceedance plots of Sacramento River Flow below Keswick 50% Unimpaired Flow Requirement**



## Figure 25 – Monthly Exceedance plots of Sacramento River Flow below Keswick 40% Unimpaired Flow Requirement



**Water Supply Impacts**

This analysis assumes that the CVP and SWP reservoirs will be operated to meet the 50% and 40% of unimpaired flow requirements; therefore, the analysis assumes that all water supply impacts would be on the CVP and SWP. As discussed above, all of the estimated water supply impacts are underestimates of the actual water supply impacts that would occur from implementation of these requirements. This is because although rules governing CalSim II's simulations of the CVP / SWP system have been developed to produce meaningful operations under a wide range of alterative scenarios, simulation of the 50% and 40% of unimpaired flow requirements requires simulation of operating conditions that would be outside of the range of CalSim II's existing rules. Nevertheless, modeling under CalSim II is the best available method of estimating the impacts of implementing such flow requirements. Additional features would need to be incorporated into the CalSim II model to estimate the full range of impacts to the water system that implementation of the 50% and 40% of unimpaired flow requirements would cause.

Table 5 contains summaries of estimated average annual water deliveries to CVP contractors under Existing Conditions and under the 50% unimpaired flow requirement, and a summary of the differences. Average annual North of Delta (NOD) deliveries would be reduced by 172,000 AF and South of Delta (SOD) would decrease by 346,000 AF. Average critical year reductions NOD would be 542,000 AF and reductions SOD would be approximately 368,000 AF. Table 6 contains summaries of estimated average annual water deliveries to CVP contractors under Existing Conditions and under the 40% unimpaired flow requirement, and a summary of the differences. Average annual North of Delta (NOD) deliveries would be reduced by 74,000 AF and South of Delta (SOD) would decrease by 140,000 AF. Average critical year reductions NOD would be 216,000 AF and reductions SOD would be approximately 172,000 AF. It is important to note that the model assumes that diversions by settlement and exchange contractors would be curtailed, both NOD and SOD, and that the model does not contain any adjustment to maintain these contractors' water diversion priorities. The model results also indicate that municipal and industrial (M&I) deliveries north and south of Delta would be reduced to levels such that public health and safety water supply needs would be difficult or impossible to satisfy.

The model results indicate that water deliveries to wildlife refuges would be reduced to extents that could have effects on the Pacific Flyway. The water supply reductions to agriculture in both the Sacramento and San Joaquin Valleys would also result in water supply reductions to wildlife refuges in these areas. Additionally, the loss of rice production acreage in the Sacramento Valley would affect the Pacific Flyway due to the loss of fall flood-up habitat.

Tables 7 and 8 contain a summary of estimated annual water deliveries to SOD SWP contractors under the Existing Conditions and 50% and 40% of unimpaired flow requirements scenarios, and a summary of the differences. The estimated average annual reductions in SOD SWP contractor deliveries is 352,000 AF in the 50% of unimpaired scenario and 191,000 AF in the 40% of unimpaired scenario. Estimated dry and critical year delivery reductions are 863,000 AF and 460,000 AF, respectively in the 50% of unimpaired flow scenario and 516,000 AF and 299,000 AF, respectively in the 40% of unimpaired flow scenario.

Figure 26 contains exceedance probability plots of CVP water supply allocations for CVP NOD agricultural service contractors, CVP SOD agricultural service contractors, CVP NOD M&I contractors, and CVP SOD M&I contractors for the Existing Conditions and 50% of unimpaired flow scenarios. Figure 27 contains this information for the 40% of unimpaired flow scenario. Under the 50% of unimpaired flow scenario, both NOD and SOD agricultural service contractors would receive no water supplies in 20% of all years, and would experience significant reductions in allocations in most years. Under 50% of unimpaired flow scenario, both NOD and SOD M&I contractors would receive 50% allocations in 20% of all years, which would result in difficulties in meeting public health and safety water needs. There would be difficulty in satisfying public health and safety water needs in the 40% of unimpaired flow study, but not to the degree of the 50% of unimpaired flow scenario. In addition to reduced water supply allocations, when project reservoirs would reach dead pool, most M&I water supply deliveries would be further reduced, and in many months would be zero.

Figures 28 and 29 contain exceedance probability plots of SWP SOD water supply allocations under both of these scenarios. The plots indicate that, in 60% of all years, SWP SOD water supply deliveries would be significantly reduced with implementation of the 50% of unimpaired flow requirements and in 50% of all years with implementation of the 40% of unimpaired flow requirements.

## Table 5 - CVP Delivery Summary (1,000 AF)

### 50% Unimpaired Flow Requirement

| | AG NOD | AG SOD | Exchange | M&I NOD | M&I SOD | Refuge NOD | Refuge SOD | Sac. Setlmnt | CVP NOD Total | CVP SOD Total |
|---|---|---|---|---|---|---|---|---|---|---|
| **Existing** | | | | | | | | | | |
| All Years | 226 | 879 | 852 | 85 | 117 | 68 | 296 | 1840 | 2219 | 2326 |
| W | 318 | 1380 | 875 | 93 | 136 | 70 | 305 | 1837 | 2318 | 2879 |
| AN | 286 | 962 | 802 | 85 | 113 | 65 | 279 | 1696 | 2131 | 2325 |
| BN | 220 | 717 | 875 | 86 | 112 | 70 | 305 | 1881 | 2257 | 2192 |
| D | 159 | 605 | 864 | 81 | 108 | 69 | 300 | 1876 | 2184 | 2061 |
| C | 53 | 233 | 741 | 68 | 87 | 56 | 252 | 1740 | 1917 | 1492 |
| **50% Unimpaired Flow Requirement** | | | | | | | | | | |
| All Years | 150 | 592 | 836 | 75 | 99 | 65 | 287 | 1758 | 2048 | 1980 |
| W | 303 | 1278 | 875 | 92 | 131 | 71 | 304 | 1836 | 2301 | 2772 |
| AN | 206 | 686 | 802 | 78 | 105 | 65 | 279 | 1695 | 2045 | 2040 |
| BN | 78 | 233 | 865 | 70 | 88 | 70 | 301 | 1859 | 2077 | 1660 |
| D | 29 | 125 | 847 | 64 | 79 | 68 | 293 | 1833 | 1994 | 1506 |
| C | 17 | 84 | 664 | 51 | 56 | 35 | 206 | 1272 | 1375 | 1124 |
| **Difference** | | | | | | | | | | |
| All Years | -75 | -286 | -17 | -10 | -18 | -3 | -9 | -83 | -172 | -346 |
| W | -15 | -103 | 0 | -1 | -4 | 0 | 0 | 0 | -16 | -107 |
| AN | -80 | -277 | 0 | -6 | -8 | 0 | 0 | 0 | -86 | -284 |
| BN | -142 | -484 | -10 | -15 | -24 | 0 | -3 | -22 | -180 | -532 |
| D | -130 | -479 | -17 | -17 | -30 | -1 | -8 | -43 | -190 | -554 |
| C | -36 | -149 | -77 | -16 | -31 | -22 | -45 | -468 | -542 | -368 |

## Table 6 - CVP Delivery Summary (1,000 AF)

### 40% Unimpaired Flow Requirement

| | AG NOD | AG SOD | Exchange | M&I NOD | M&I SOD | Refuge NOD | Refuge SOD | Sac. Setlmnt | CVP NOD Total | CVP SOD Total |
|---|---|---|---|---|---|---|---|---|---|---|
| **Existing** | | | | | | | | | | |
| All Years | 226 | 879 | 852 | 85 | 117 | 68 | 296 | 1840 | 2219 | 2326 |
| W | 318 | 1380 | 875 | 93 | 136 | 70 | 305 | 1837 | 2318 | 2879 |
| AN | 286 | 962 | 802 | 85 | 113 | 65 | 279 | 1696 | 2131 | 2325 |
| BN | 220 | 717 | 875 | 86 | 112 | 70 | 305 | 1881 | 2257 | 2192 |
| D | 159 | 605 | 864 | 81 | 108 | 69 | 300 | 1876 | 2184 | 2061 |
| C | 53 | 233 | 741 | 68 | 87 | 56 | 252 | 1740 | 1917 | 1492 |
| **40% Unimpaired Flow Requirement** | | | | | | | | | | |
| All Years | 190 | 756 | 850 | 80 | 110 | 66 | 292 | 1809 | 2145 | 2186 |
| W | 313 | 1346 | 875 | 92 | 135 | 70 | 304 | 1837 | 2312 | 2843 |
| AN | 256 | 896 | 802 | 82 | 113 | 65 | 279 | 1695 | 2099 | 2258 |
| BN | 158 | 500 | 875 | 80 | 104 | 70 | 305 | 1881 | 2188 | 1968 |
| D | 88 | 375 | 860 | 72 | 99 | 68 | 300 | 1850 | 2079 | 1816 |
| C | 31 | 144 | 730 | 59 | 68 | 47 | 230 | 1565 | 1701 | 1320 |
| **Difference** | | | | | | | | | | |
| All Years | -36 | -123 | -2 | -5 | -6 | -1 | -4 | -32 | -74 | -140 |
| W | -5 | -34 | 0 | -1 | -1 | 0 | -1 | 0 | -6 | -36 |
| AN | -29 | -67 | 0 | -2 | 0 | 0 | 0 | 0 | -32 | -67 |
| BN | -63 | -217 | 0 | -6 | -7 | 0 | 0 | 0 | -69 | -225 |
| D | -71 | -229 | -4 | -9 | -9 | 0 | 0 | -26 | -106 | -244 |
| C | -22 | -88 | -11 | -9 | -19 | -9 | -21 | -176 | -216 | -172 |

**Table 7 - SWP South of Delta Delivery Summary (1,000 AF)**

**50% Unimpaired Flow Requirement**

| | MWD | "Other" M&I | AG SOD | Art. 56 | Art 21 | M&I | Table A | Total |
|---|---|---|---|---|---|---|---|---|
| **Existing** | | | | | | | | |
| All Years | 1037 | 610 | 596 | 303 | 71 | 1647 | 2242 | 2616 |
| W | 1186 | 713 | 738 | 393 | 140 | 1899 | 2637 | 3169 |
| AN | 1065 | 606 | 601 | 222 | 60 | 1671 | 2271 | 2554 |
| BN | 1121 | 641 | 618 | 376 | 31 | 1762 | 2380 | 2788 |
| D | 1001 | 582 | 535 | 225 | 39 | 1583 | 2118 | 2382 |
| C | 551 | 348 | 298 | 196 | 21 | 899 | 1196 | 1414 |
| **50% Unimpaired Flow Requirement** | | | | | | | | |
| All Years | 906 | 540 | 521 | 232 | 66 | 1446 | 1967 | 2264 |
| W | 1202 | 711 | 738 | 328 | 120 | 1913 | 2651 | 3099 |
| AN | 1067 | 605 | 600 | 148 | 113 | 1672 | 2272 | 2533 |
| BN | 968 | 578 | 521 | 297 | 41 | 1546 | 2067 | 2404 |
| D | 619 | 387 | 334 | 168 | 11 | 1006 | 1339 | 1519 |
| C | 388 | 243 | 210 | 107 | 6 | 631 | 841 | 954 |
| **Difference** | | | | | | | | |
| All Years | -131 | -70 | -75 | -71 | -5 | -201 | -275 | -352 |
| W | 15 | -1 | 0 | -65 | -19 | 14 | 14 | -70 |
| AN | 2 | -1 | -1 | -74 | 53 | 1 | 0 | -21 |
| BN | -154 | -62 | -98 | -80 | 10 | -216 | -314 | -384 |
| D | -383 | -195 | -201 | -56 | -28 | -578 | -779 | -863 |
| C | -163 | -105 | -88 | -89 | -16 | -268 | -356 | -460 |

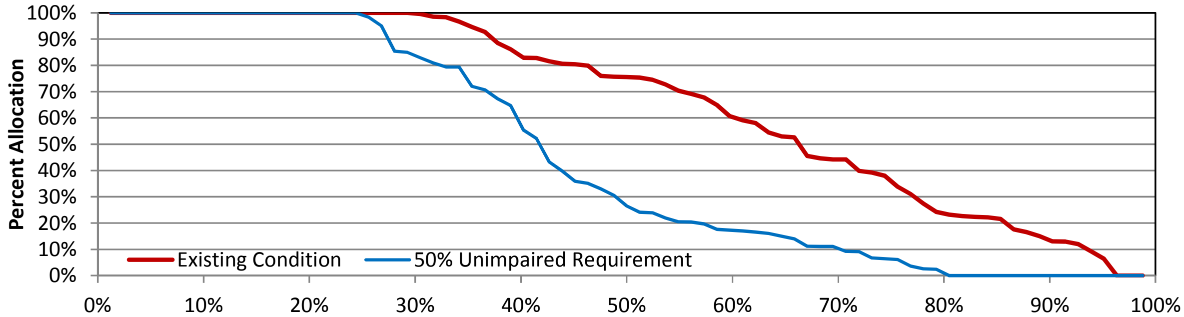
**Table 8 - SWP South of Delta Delivery Summary (1,000 AF)**

**40% Unimpaired Flow Requirement**

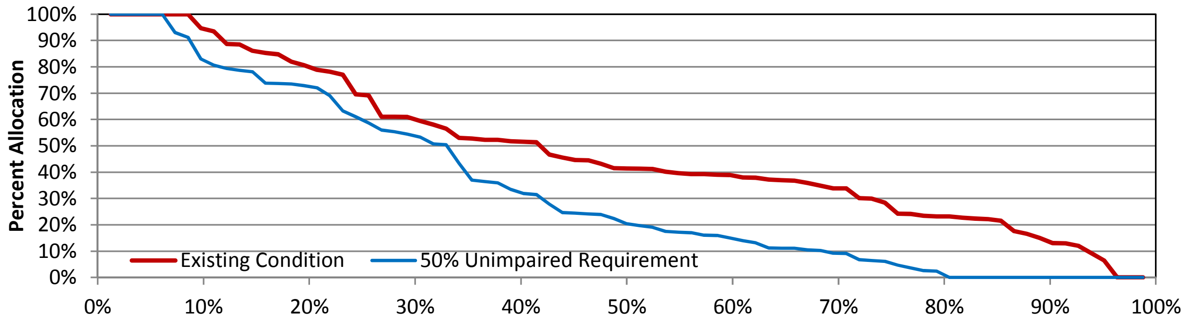
| | MWD | "Other" M&I | AG SOD | Art. 56 | Art 21 | M&I | Table A | Total |
|---|---|---|---|---|---|---|---|---|
| **Existing** | | | | | | | | |
| All Years | 1037 | 610 | 596 | 303 | 71 | 1647 | 2242 | 2616 |
| W | 1186 | 713 | 738 | 393 | 140 | 1899 | 2637 | 3169 |
| AN | 1065 | 606 | 601 | 222 | 60 | 1671 | 2271 | 2554 |
| BN | 1121 | 641 | 618 | 376 | 31 | 1762 | 2380 | 2788 |
| D | 1001 | 582 | 535 | 225 | 39 | 1583 | 2118 | 2382 |
| C | 551 | 348 | 298 | 196 | 21 | 899 | 1196 | 1414 |
| **40% Unimpaired Flow Requirement** | | | | | | | | |
| All Years | 968 | 571 | 555 | 265 | 65 | 1539 | 2094 | 2425 |
| W | 1194 | 712 | 738 | 356 | 142 | 1906 | 2644 | 3142 |
| AN | 1064 | 601 | 598 | 211 | 69 | 1666 | 2263 | 2543 |
| BN | 1096 | 619 | 586 | 317 | 41 | 1715 | 2301 | 2659 |
| D | 777 | 475 | 419 | 189 | 7 | 1251 | 1671 | 1866 |
| C | 438 | 278 | 237 | 155 | 6 | 717 | 954 | 1115 |
| **Difference** | | | | | | | | |
| All Years | -69 | -39 | -41 | -37 | -6 | -107 | -148 | -191 |
| W | 7 | -1 | 0 | -36 | 2 | 7 | 7 | -28 |
| AN | 0 | -5 | -3 | -11 | 9 | -5 | -8 | -10 |
| BN | -25 | -22 | -33 | -59 | 10 | -47 | -79 | -129 |
| D | -225 | -107 | -116 | -35 | -33 | -332 | -448 | -516 |
| C | -113 | -69 | -61 | -41 | -15 | -182 | -243 | -299 |

**Figure 26 – CVP Water Supply Allocation**
**50% Unimpaired Flow Requirement**

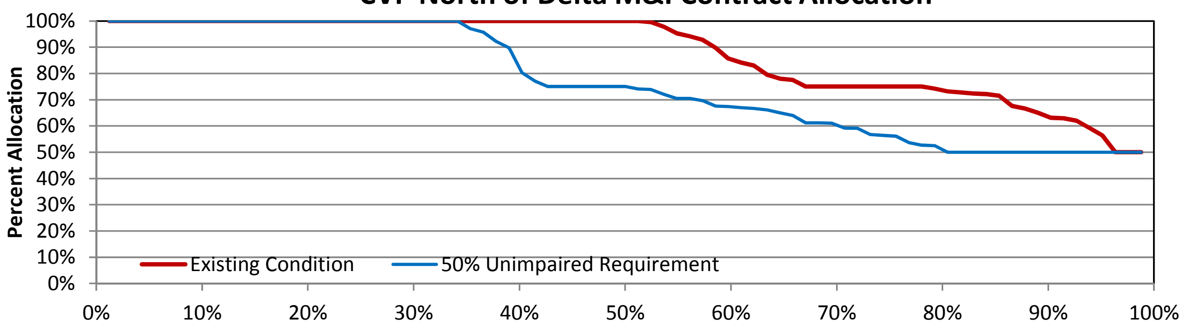
CVP North of Delta Agricultural Service Contract Allocation




CVP South of Delta Agricultural Service Contract Allocation




CVP North of Delta M&I Contract Allocation




CVP South of Delta M&I Contract Allocation

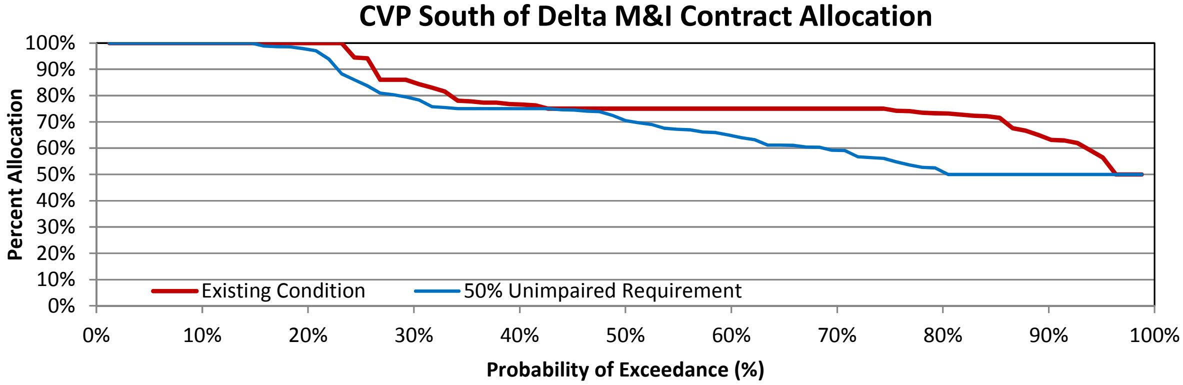
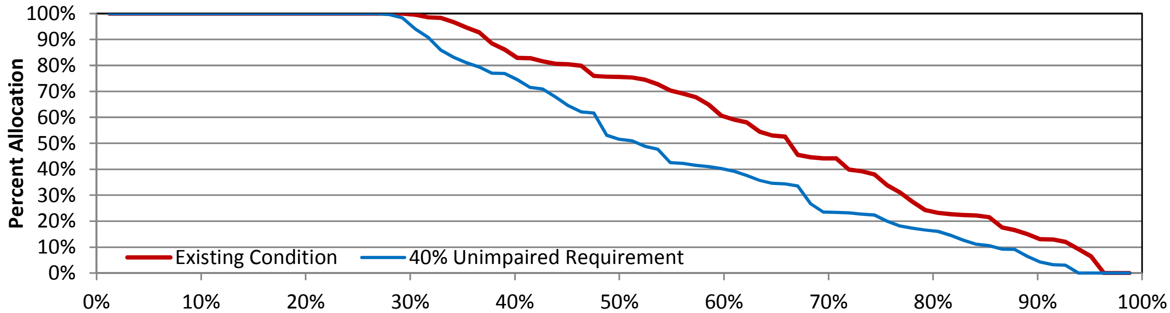
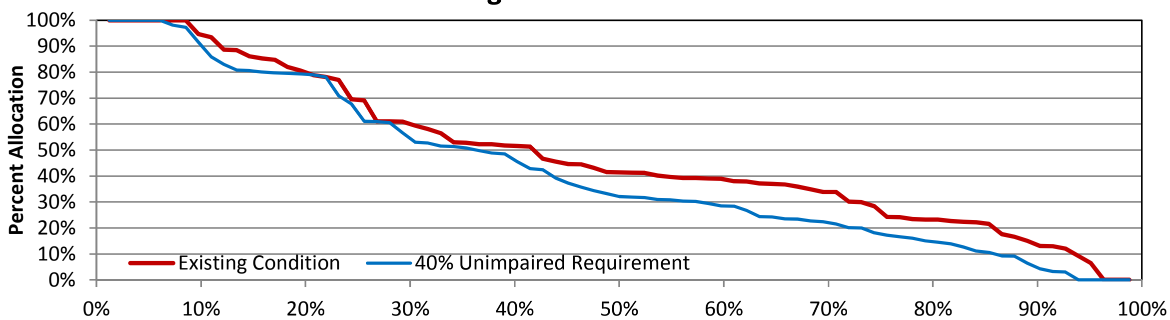


**Figure 27 – CVP Water Supply Allocation**
**40% Unimpaired Flow Requirement**

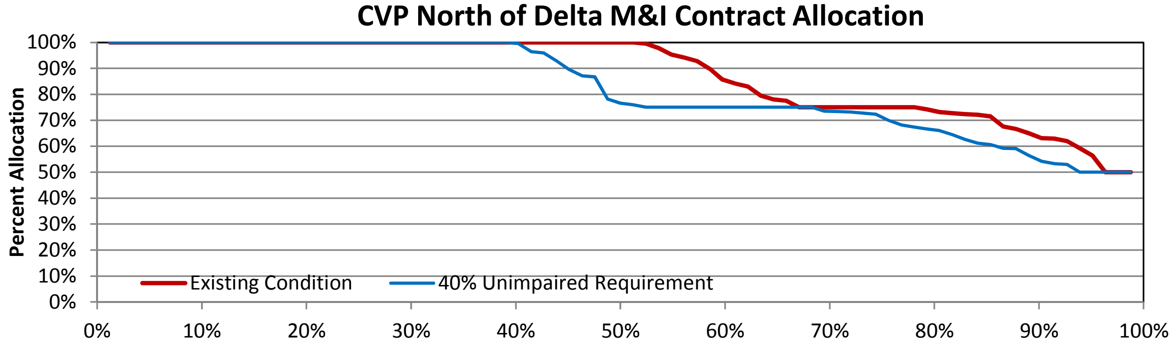
CVP North of Delta Agricultural Service Contract Allocation




CVP South of Delta Agricultural Service Contract Allocation




CVP North of Delta M&I Contract Allocation




CVP South of Delta M&I Contract Allocation

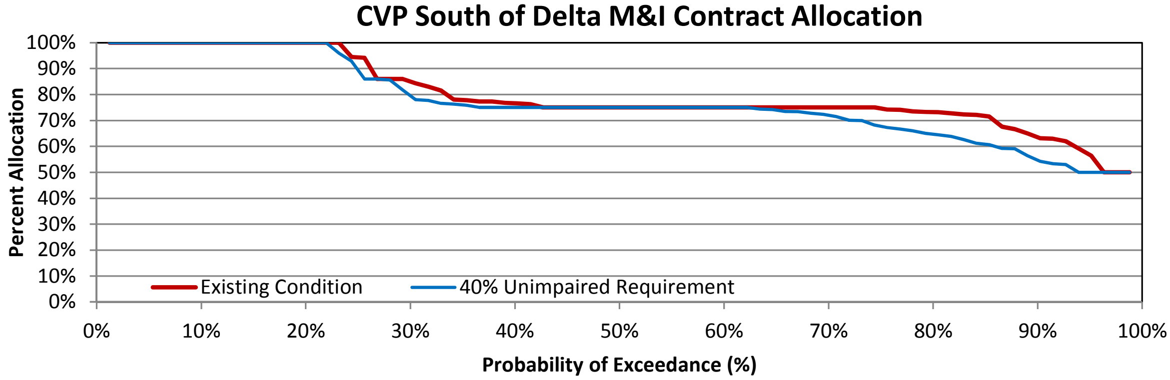


**Figure 28 – SWP Water Supply Allocation**
**50% Unimpaired Flow Requirement**

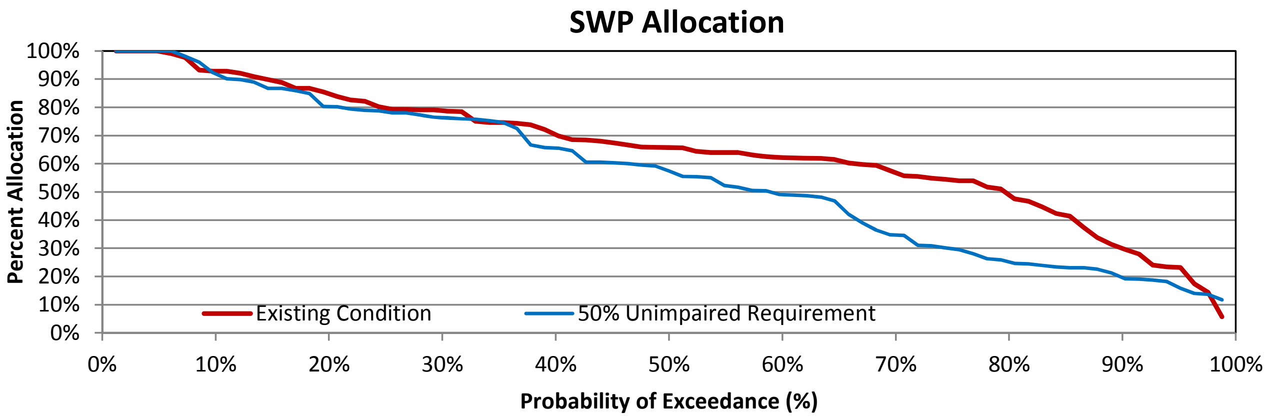
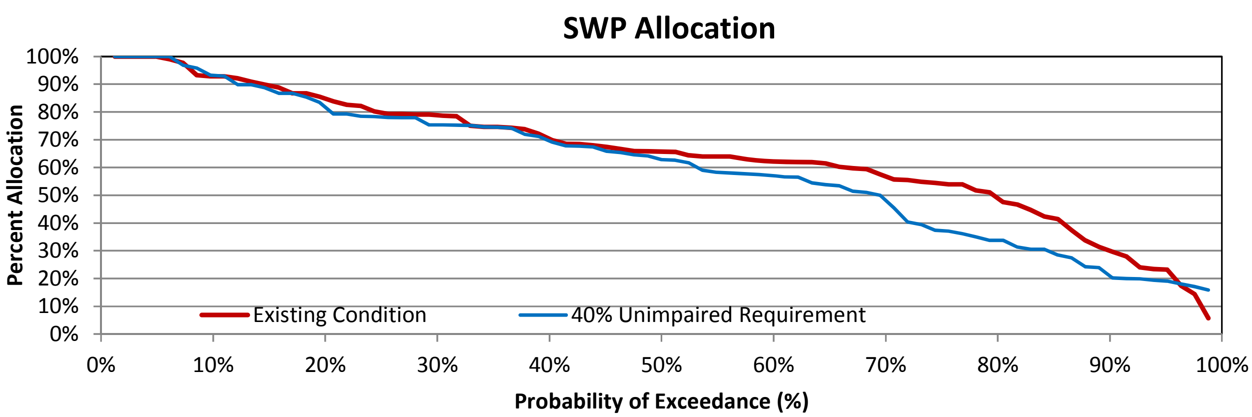



**Figure 29 – SWP Water Supply Allocation**
**40% Unimpaired Flow Requirement**



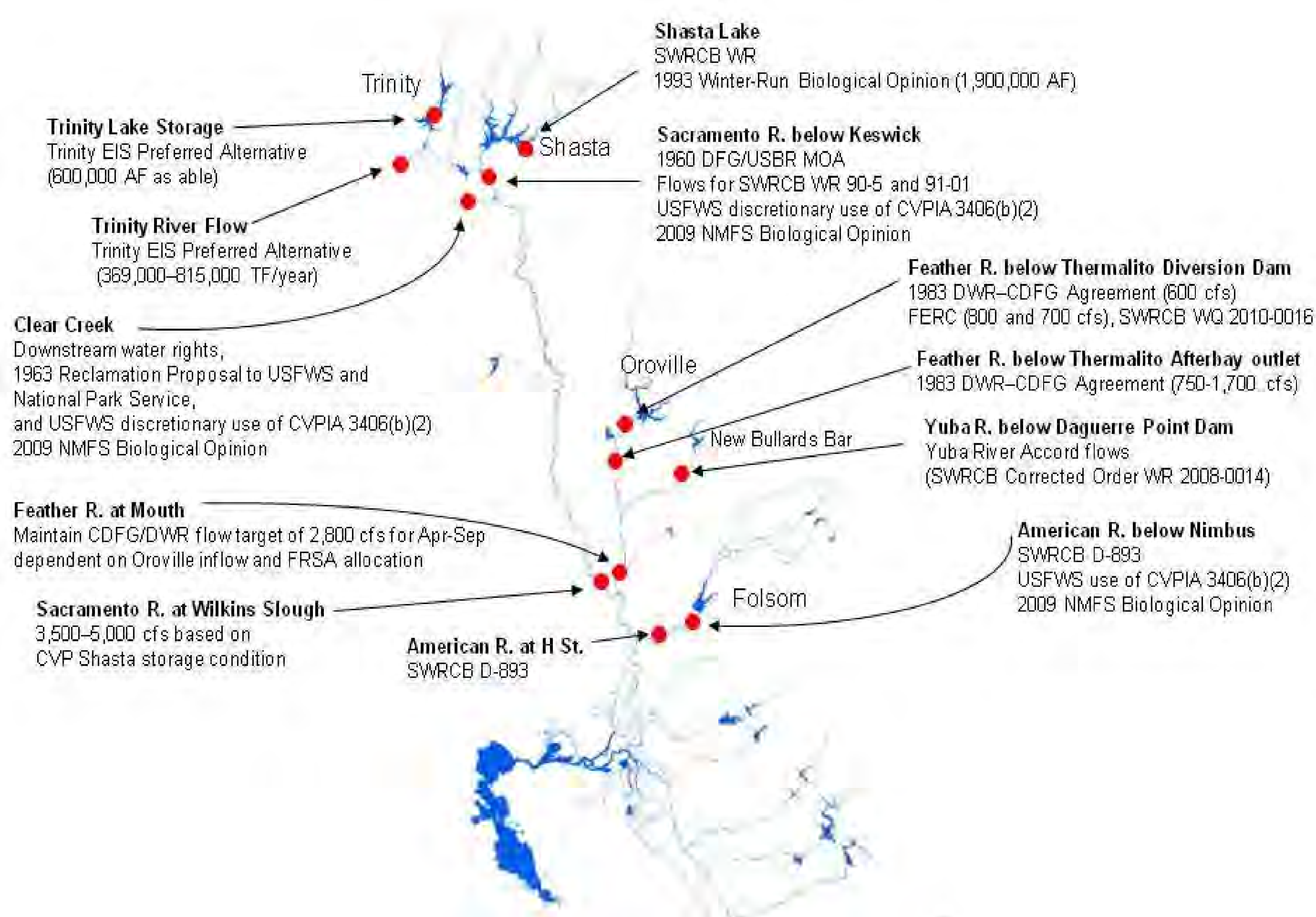
# EXHIBIT 3

# EXHIBIT 4

# Instream Flow Requirements in the Sacramento River Hydrologic Region September 2011

This briefing paper demonstrates the existing instream flow requirements for the major rivers and streams in the Sacramento River hydrologic region. This includes requirements in State Water Resources Control Board (SWRCB) decisions, biological opinions, streamflow agreements, and other processes. New processes to develop different flow requirements should be aware of, and take into account, these existing flow requirements.

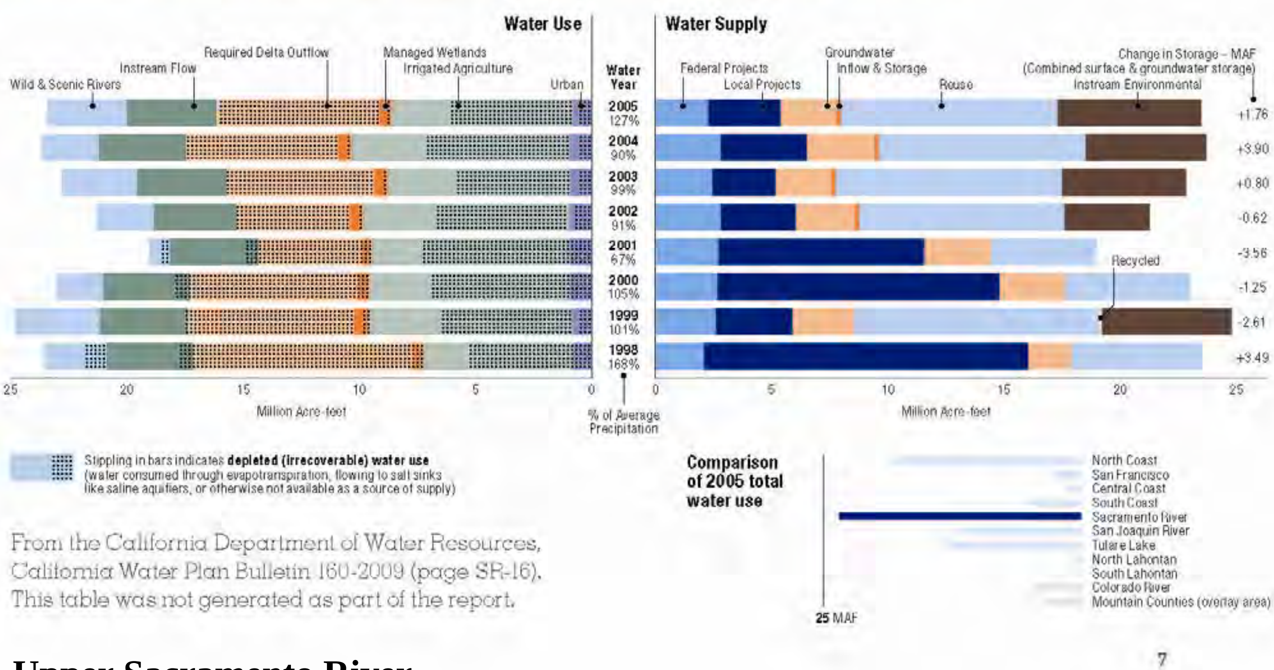
## Existing Flow Requirements - Sacramento Valley Hydrologic Region



## Regional Water Balance

The following water balance, prepared by the Department of Water Resources as part of the California Water Plan (Bulletin 160-2009), shows a significant part of water in this region is dedicated to instream flows and required Delta outflow.

Sacramento River Hydrologic Region Water Balance Summary, 1998-2005




From the California Department of Water Resources, California Water Plan Bulletin 160-2009 (page SR-16). This table was not generated as part of the report.

## Upper Sacramento River

*1.	1960 MOA between Reclamation and DFG*

An April 5, 1960, Memorandum of Agreement (MOA) between Reclamation and the DFG originally established flow objectives in the Sacramento River for the protection and preservation of fish and wildlife resources. The agreement provided for minimum releases into the natural channel of the Sacramento River at Keswick Dam for normal and critically dry years (Table 1, below). Since October 1981, Keswick Dam has operated based on a minimum release of 3,250 cfs for normal years from September 1 through the end of February, in accordance with the MOA. This release schedule was included in Order 90-05 (described below), which maintains a minimum release of 3,250 cfs at Keswick Dam and Red Bluff Diversion Dam (RBDD) from September through the end of February in all water years, except critically dry years.

The 1960 MOA provides that releases from Keswick Dam (from September 1 through December 31) are made with minimum water level fluctuation or change to protect salmon to the extent compatible with other operations requirements. Releases from Shasta and Keswick Dams are gradually reduced in September and early October during the transition from meeting Delta export and water quality demands to operating the system for flood control and fishery concerns from October through December.

*2. SWRCB Water Rights Order 90-05 and Water Rights Order 91-01*

In 1990 and 1991, the SWRCB issued Water Rights Orders 90-05 and 91-01 modifying Reclamation's water rights for the Sacramento River. The orders stated Reclamation shall operate Keswick and Shasta Dams and the Spring Creek Powerplant to meet a daily average water temperature of 56°F as far downstream in the Sacramento River as practicable during periods when higher temperature would be harmful to fisheries. The optimal control point is the RBDD.

Under the orders, the water temperature compliance point may be modified when the objective cannot be met at RBDD. In addition, Order 90-05 modified the minimum flow requirements initially established in the 1960 MOA for the Sacramento River below Keswick Dam. The water right orders also recommended the construction of a Shasta Temperature Control Device (TCD) to improve the management of the limited cold water resources.

Pursuant to SWRCB Orders 90-05 and 91-01, Reclamation configured and implemented the Sacramento-Trinity Water Quality Monitoring Network to monitor temperature and other parameters at key locations in the Sacramento and Trinity Rivers. The SWRCB orders also required Reclamation to establish the Sacramento River Temperature Task Group (SRTTG) to formulate, monitor, and coordinate temperature control plans for the upper Sacramento and Trinity Rivers. This group consists of representatives from Reclamation, SWRCB, NMFS, the Service, DFG, Western, DWR, and the Hoopa Valley Indian Tribe.

Each year, with finite cold water resources and competing demands usually an issue, the SRTTG devises operation plans with the flexibility to provide the best protection consistent with the CVP's temperature control capabilities and considering the annual needs and seasonal spawning distribution monitoring information for winter-run and fall-run Chinook salmon. In every year since the SWRCB issued the orders, those plans have included modifying the RBDD compliance point to make best use of the cold water resources based on the location of spawning Chinook salmon. Reports are submitted periodically to the SWRCB over the temperature control season defining the temperature operation plans. The SWRCB has overall authority to determine if the plan is sufficient to meet water right permit requirements.

*3. June 4, 2009 NMFS Biological Opinion*

The National Marine Fisheries Service's (NMFS) June 4, 2009, Biological Opinion and Conference Opinion on the Long-Term Operations of the Central Valley Project and State Water Project (NMFS BiOp) contains numerous terms and conditions addressing instream flows on the Upper Sacramento River.

Table 1 below, as excerpted from the NMFS BiOp (at page 254), identifies the aforementioned MOA and SWRCB order requirements, and Reclamation's proposed flow objectives below Keswick that were analyzed in the NMFS BiOp.

**Table 1: Minimum flow requirements and objectives (cfs) on the Sacramento River below Keswick Dam**

| Water year type | MOA | WR 90-5 | MOA and WR 90-5 | Proposed Flow Objectives below Keswick |
|---|---|---|---|---|
| Period | Normal | Normal | Critically dry | All |
| January 1 - February 28(29) | 2600 | 3250 | 2000 | 3250 |
| March 1 - March 31 | 2300 | 2300 | 2300 | 3250 |
| April 1 - April 30 | 2300 | 2300 | 2300 | ---* |
| May 1 - August 31 | 2300 | 2300 | 2300 | ---* |
| September 1 - September 30 | 3900 | 3250 | 2800 | ---* |
| October 1 - November 30 | 3900 | 3250 | 2800 | 3250 |
| December 1 - December 31 | 2600 | 3250 | 2000 | 3250 |
| Note: * No regulation. | | | | |

The flow related components of the NMFS BiOp related to the Sacramento River Basin are detailed in the Reasonable and Prudent Alternatives (RPA) section of BiOp at pages 587 through 611. The RPA Actions include flow requirements on Clear Creek; release requirements from Whiskeytown Dam for temperature management; cold water pool management of Shasta Reservoir; development of recommended minimum flows at Wilkins Slough; and restoration of floodplain habitat in the lower Sacramento River basin for protection of certain listed species. A selection of the more specific flow-related requirements are described below.

*Clear Creek Operations*

*RPA Action I.1.1 - Clear Creek Spring Attraction Flows*

Reclamation shall annually conduct at least two pulse flows in Clear Creek in May and June of at least 600 cfs for at least three days for each pulse, to attract adult spring-run holding in the Sacramento River main stem. This may be done in conjunction with channel-maintenance flows (Action I.1.2).

*RPA Action I.1.2. – Clear Creek Channel Maintenance Flows*

Reclamation shall re-operate Whiskeytown Glory Hole spills during the winter and spring to produce channel maintenance flows of a minimum of 3,250 cfs mean daily spill from Whiskeytown for one day, to occur seven times in a ten-year period, unless flood control operations provide similar releases. Re-operation of Whiskeytown Dam should be implemented with other project facilities as described in the EWP Pilot Program (Reclamation 2008d).

*RPA Action I.1.5. – Clear Creek Thermal Stress Reduction*

Reclamation shall manage Whiskeytown releases to meet a daily water temperature of:

(1) 60 deg. F at the Igo gage from June 1 through September 15; and

(2) 56 deg. F at the Igo gage from September 15 to October 31.

Reclamation, in coordination with NMFS, will assess improvements to modeling water temperatures in Clear Creek and identify a schedule for making improvements.

*RPA Action I.1.6. - Adaptively Manage to Habitat Suitability/IFIM Study Results on Clear Creek*

Reclamation shall operate Whiskeytown Reservoir as described in the Project Description with the modifications described in Action I.1 until September 30, 2012, or until 6 months after current Clear Creek salmonids habitat suitability (*e.g*., IFIM) studies are completed, whichever occurs later.

When the salmonid habitat suitability studies are completed, Reclamation will, in conjunction with the Clear Creek Technical Working Group (CCTWG), assess whether Clear Creek flows shall be further adapted to reduce adverse impacts on spring-run and CV steelhead, and report their findings and proposed operational flows to NMFS within 6 months of completion of the studies. NMFS will review this report and determine whether the proposed operational flows are sufficient to avoid jeopardizing spring-run and CV steelhead or adversely modifying their critical habitat.

Reclamation shall implement the flows on receipt of NMFS' written concurrence. If NMFS does not concur, NMFS will provide notice of the insufficiencies and alternative flow recommendations. Within 30 days of receipt of non-concurrence by NMFS, Reclamation shall convene the CCTWG to address NMFS' concerns. Reclamation shall implement flows deemed sufficient by NMFS in the next calendar year.

*<u>Shasta Operations</u>*

*RPA Action Suite I.2 – Shasta Operations*

This suite of actions is designed to ensure that Reclamation uses maximum discretion to reduce adverse impacts of the projects to winter-run and spring-run in the Sacramento River by maintaining sufficient carryover storage and optimizing use of the cold water pool.

*RPA Action I.2.1 – Performance Measures*

The following long-term performance measures shall be attained. Reclamation shall track performance and report to NMFS at least every 5 years. If there is significant deviation from these performance measures over a 10-year period, measured as a running average, which is not explained by hydrological cycle factors (*e.g.*, extended drought), then Reclamation shall reinitiate consultation with NMFS.

Performance measures for end-of-season ("EOS") carryover storage at Shasta Reservoir:

- 87 percent of years: Minimum EOS storage of 2.2 MAF
- 82 percent of years: Minimum EOS storage of 2.2 MAF and end-of-April storage of 3.8 MAF in following year (to maintain potential to meet Balls Ferry compliance point)
- 40 percent of years: Minimum EOS storage 3.2 MAF (to maintain potential to meet Jelly's Ferry compliance point in following year)

Measured as a 10-year running average, performance measures for temperature compliance points during summer season shall be:

- Meet Clear Creek Compliance point 95 percent of time
- Meet Balls Ferry Compliance point 85 percent of time
- Meet Jelly's Ferry Compliance point 40 percent of time
- Meet Bend Bridge Compliance point 15 percent of time

*RPA Actions I.2.2 through I.2.4 – Keswick Release Schedules*

Depending on EOS carryover storage and hydrology, Reclamation is mandated to develop and implement Keswick release schedules, and reduce deliveries and exports, as detailed in RPA Actions I.2.2.A through I.2.2C, I.2.3.A through I.2.3.C, and I.2.4. (See NMFS BiOp at pp. 593-603.)

*<u>Required Technical Teams for Adaptive Management</u>*

The NMFS BiOp requires actions by various Fisheries and Operations Technical Teams whose function is to make recommendations for adjusting operations to meet contractual obligations for water delivery and minimize adverse effects on listed anadromous fish species. The two teams on the Upper Sacramento River are the SRTTG and the CCTWG. Each group must gather and analyze information, and make recommendations, regarding adjustments to water operations within the range of flexibility prescribed in the implementation procedures for a specific action in their particular geographic area.

*4. Wilkins Slough Navigation Flow Requirements Under Federal Law*

The NMFS BiOp requires the development of certain recommendations regarding the Wilkins Slough navigation flow requirements. Reclamation's compliance with the Wilkins Slough 5,000 cfs navigation flow standard, however, is not discretionary.

In this regard, Congress initially authorized the construction of certain facilities for the Central Valley Project ("CVP") under the Rivers and Harbors Act of 1935 (the "1935 Act"). (49 Stat. 1028, 1038). The 1935 Act mandated in relevant part that "the following works of improvement of rivers . . . are hereby adopted and authorized . . . in accordance with the plans recommended in the respective reports hereinafter designated and subject to the conditions set forth in such documents . . . Sacramento River, California; Rivers and Harbors Committee Document Numbered 35, Seventy-third Congress . . . ." (50 Stat. 1028, 1038.) As such, the 1935 Act incorporates by reference, and expressly requires the implementation of, the recommendations of the Rivers and Harbors Committee Document Number 35. This document is a 1934 report from the Corps' Chief Engineer recommending to Congress that Kennett Dam (predecessor to Shasta Dam) "shall be operated so as to provide a minimum flow of 5,000 cubic feet per second between Chico Landing and Sacramento." (*See* Central Valley Project Documents, Part I, 544, 548 [Committee Doc. 35, 73rd Cong.].)

Congress re-authorized the CVP under the Rivers and Harbors Act of 1937 (the "1937 Act"). (50 Stat. 844, 850.)[1] This re-authorization mandated in relevant part that "the $12,000,000 recommended for expenditure for a part of the Central Valley project, California, in accordance with the plans set forth in Rivers and Harbors Committee Document Numbered 35, Seventy-third Congress, and adopted and authorized by the provisions of section 1 of the Act of August 30, 1935 (49 Stat. 1028, at 1038) . . . shall, when appropriated, be available for expenditure in accordance with the said plans of the Secretary of Interior instead of the Secretary of War." (50 Stat. 844, 850.) As such, the 1937 Act also incorporates by reference, and expressly requires the implementation of, the recommended minimum flow of 5,000 cfs between Chico Landing and Sacramento. There has been no subsequent action by Congress that has "discontinued" or otherwise changed this minimum navigation flow requirement.

The 1937 Act also mandates that CVP "dams and reservoirs *shall* be used, *first*, for river regulation, improvement of navigation, and flood control; second, for irrigation and domestic uses; and, third, for power." (50 Stat. 844, 850, emphasis added; *see also United States v. SWRCB* (1986) 182 Cal.App.3d 82, 135.) In 1992, Congress explicitly amended this hierarchy of use by enacting sections 3406(a) and (b) of the Central Valley Project Improvement Act (Pub. L. No. 102-575 (1992)), which make protection of non-ESA listed fish and wildlife co-equal priorities with irrigation. Even with this amendment, however, Reclamation's first priority remains river regulation, navigation and flood control.

On the Sacramento River, all major diversions have positive barrier flat-plate fish screens installed that provide protection to listed fishery species. These screens have been designed with an approach velocity of 0.33 ft/s as required by NMFS and the Department of Fish and Game. During design, the screens, velocities, and diversion rates were based upon the Wilkins Slough Navigational Flow requirement of 5,000 cfs since this requirement under federal law was controlling.

The NMFS BiOp states that flows could be reduced to 3,250 cfs, which is lower than the Wilkins Slough flow requirement. If the Bureau of Reclamation reduced flows below the Wilkins Slough control point requirement and depending on the diversion rate, some screens may not meet the velocity criteria as designed. The agencies should coordinate with the Sacramento River diverters to develop contingency plans and wells as a coordinated operations plan that would benefit the Sacramento River system for fisheries and water users.

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1 *See also Stockton East Water District, et al. v. United States*, 583 F.3d 1344, 1349 (Fed. Cir. 2009) [citing to the 1935 and 1937 Acts as Congress' initial authorization and reauthorization of the CVP].

## Lower American River

The American River provides important fish and wildlife habitat, a high-quality water source, a critical floodway, and a spectacular regional recreational parkway. The Bureau of Reclamation (Reclamation) operates Folsom and Nimbus dams to provide flood control and water for irrigation, municipal and industrial uses, hydroelectric power, recreation, water quality, and the protection of aquatic resources.

In April of 2000, a diverse group of over 40 local business and agricultural leaders, citizen groups, environmentalists, water managers and local governments ended decades of conflict by signing the Water Forum Agreement (WFA). The foundational elements of the WFA are two coequal objectives: to provide a reliable safe water supply for the region and to preserve fishery, wildlife, recreational, and aesthetic values of the lower American River.

Working in cooperation with Reclamation, California Department of Fish and Game, National Marine Fisheries Service, Fish and Wildlife Service, the Water Forum developed the Flow Management Standard (FMS) as an alternative to D-893 (the current instream flow requirements on the lower American River). The FMS is intended to improve the condition of aquatic resources in the lower American River, particularly fall-run Chinook salmon and steelhead. In addition, the FMS benefits other fish species, the aquatic environment and the riparian ecosystem of the lower American River Corridor. Designed to achieve these benefits over a wide range of hydrologic conditions, the FMS provides a forum through which biologic and ecologic factors are considered in the river management process, and provides for the analysis of hydrologic and biologic information collected though the monitoring and evaluation component.

The lower American River FMS is designed to allocate flow releases from Folsom and Nimbus dams in consideration of variable hydrology and coldwater pool availability in Folsom Reservoir. The FMS includes: (1) minimum flow requirements; (2) water temperature objectives; (3) implementation criteria; (4) an agency group to address river management and operational actions (the American River Group); and (5) a monitoring and evaluation component.

### *1. Minimum Flow Requirements*

The minimum flow requirements prescribe the flows in the lower American River water to meet fishery needs throughout the entire water year. These minimum flow requirements include minimum release requirements (MRR) measured downstream of Nimbus Dam, and downstream flow requirements (250 cfs from January through mid-September and 500 cfs from mid-September through December) between Nimbus Dam and the mouth of the lower American River. The prescribed flows are minimums only and do not preclude Reclamation from making higher releases.

The MRR varies from 800 to 2,000 cfs throughout the year in response to the hydrology of the Sacramento and American River basins and a set of prescriptive and discretionary adjustments. As such, the specified MRR is higher in wet years and lower in dry years. These adjustments are made in response to specific conditions related to the need for spawning flow progressions, fish protection, and reservoir water conservation. The resultant MRR varies throughout the season as shown in Table 1.

**Table 1. Seasonal Variation in the Minimum Release Requirement**

| Time Period | MRR Range (cfs) | Index | Relevance of Index |
|---|---|---|---|
| October | 800 to 1,500 | Four Reservoir Index (FRI) | Indicates the amount of upstream storage available during the fall and winter months |
| November and December | 800 to 2,000 | FRI | |
| January and February | 800 to 1,750 | Sacramento River Index (SRI) | Indicates current multi-basin water availability |
| March through Labor Day | 800 to 1,750 | Folsom Inflow Index (IFII) | Forecasts water availability for the American River Basin for the remainder of the current water year |
| Post-Labor Day through September | 800 to 1,500 | IFII | |

The FMS also includes exceptions to the MRR during extreme dry conditions, including:

- **Conference Years:** Occur when the projected March through November unimpaired inflow to Folsom Reservoir is less than 400,000 AF. A minimum flow of 190 cfs is required downstream of the H Street Bridge.
- **Off-ramp Criteria:** Triggered if Folsom Reservoir storage is forecasted to fall below 200,000 AF in the succeeding 12 months. In this case, downstream flow requirements rather than MRR become the minimum flow requirement throughout the lower American River.

### *2. Water Temperature Objectives*

The water temperature objectives of the FMS have been developed to allocate the available lower American River cold water resources for juvenile steelhead rearing in summer, and fall-run Chinook salmon spawning in fall. These objectives are met through use of an Annual Operations Forecast (Operations Forecast) and Annual Water Temperature Management Plan (Temperature Plan).

The Operations Forecast will be prepared by May 1 of each year to describe forecasted American River operations, including flows and water temperatures for the next 12 months, with implementation of the Minimum Flow Requirements and Water Temperature Objectives.

The Temperature Plan will be developed by May 1 of each year to describe how Reclamation will meet the following water temperature objectives for the lower American River:

- 65ºF or less from May 15 through October at Watt Avenue for steelhead juvenile rearing. This objective may be relaxed to 68ºF if Temperature Plan analysis indicates that lower temperature targets will prematurely exhaust the available cold water.

- 60ºF or less as early in October as possible at Hazel Avenue for Chinook salmon spawning and egg incubation.

### *3. Implementation Criteria*

Implementation criteria serve as a tool to determine the conditions by which the FMS Minimum Flow Requirements may be implemented, and to define the method of measuring compliance with the FMS Minimum Flow Requirements. The implementation criteria that are applied for decision-making purposes regarding operational adjustments affecting lower American River flows and water temperatures address the following: (1) end-of-month Folsom Reservoir storage, particularly during May and September; (2) Nimbus Dam releases and flows at the mouth of the lower American River measured over a 5-day averaging period; (3) water conservation adjustments; (4) fish protection adjustments; and (5) other considerations.

### *4. Lower American River Group*

The Lower American River Group (ARG) is an advisory group consisting of agency representatives convened regularly by Reclamation. Through the regularly scheduled ARG meetings, which are open to the public, the ARG provides information to the public and formulates CVP operational recommendations for the protection of fisheries and other in-stream resources consistent with the FMS.

### *5. Monitoring and Evaluation*

Monitoring and evaluation of physical and biological factors are included in the FMS to provide information to support operational decisions and to evaluate operational effects on the aquatic resources of the lower American River including river hydrology, water temperature, salmonid population and downstream movement.

## Current Status

Sacramento County recently adopted a revised American River Parkway Plan which includes specific policies related to implementing water flows protective of the lower American River ecosystem. The Parkway Plan serves as a guide for other local, state and federal agencies with authority within the American River Parkway under the Wild and Scenic Rivers Act and the Urban American River Parkway Preservation Act. Sacramento County, through the Water Forum, is in the process of preparing a draft environmental impact report to institute the FMS consistent with the American River Parkway Plan and the coequal goals of the Water Forum Agreement by entering into an operations agreement with Reclamation or by seeking to modify Reclamation's Folsom Dam water right permit through a petition to the SWRCB, or both.

Reclamation has been operating the Folsom dam in accordance with the minimum release requirements of the FMS since 2006. In 2009, the National Marine Fisheries Service (NMFS) included the FMS flow, operational criteria, American River Group, and monitoring requirements in the Reasonable and Prudent Alternatives of the Biological Opinion (BO) for operating the CVP. The NMFS BO also called for an iterative temperature management planning process that is consistent with the water temperature objectives of the FMS.

## Yuba River

In 2008, the State Water Resources Control Board (the SWRCB) adopted streamflow requirements and related measures proposed by Yuba County Water Agency (YCWA) that implemented the Yuba River Accord Fisheries Agreement that YCWA developed with the Department of Fish and Game (DFG), the National Marine Fisheries Service (NMFS), the U.S. Fish and Wildlife Service (USFWS) and several conservation groups. The Accord and the SWRCB's related order – Corrected Order WR 2008-14 – resolved 20 years of disputes concerning the Yuba River's streamflows. The Accord streamflow requirements, as implemented by the SWRCB, are depicted on Exhibit A. The SWRCB adopted Corrected Order WR 2008-14 based on a $6 million environmental impact report that YCWA certified and that was not challenged in court. The Yuba River Accord is summarized below and additional information is available on YCWA's Web site at http://www.ycwa.com/projects/detail/8.

Disputes concerning the Yuba River's streamflows began in 1988 and continued through a 14-day SWRCB hearing in 1992, a 13-day SWRCB hearing in 2000 and a three-day SWRCB hearing in 2003. In 2003, the SWRCB adopted Revised Water Right Decision 1644 (RD-1644) and many lawsuits, including one by YCWA, were filed to challenge RD-1644.

As an alternative to litigating these disputes to a conclusion, YCWA, DFG, NMFS, USFWS and environmental groups engaged in a collaborative, science-based process to identify and prioritize the key stressors on salmon and steelhead in the lower Yuba River and then develop streamflow requirements that would address these stressors. The resulting Yuba Accord Fisheries Agreement sets new, substantially-higher streamflow requirements that allocate more water to fishery benefits than RD-1644 would have required. Specifically, the Fisheries Agreement's streamflow schedules include up to more than 174,000 acre-feet of water annually, and more than 100,000 acre-feet in the springtime of about 60% of all years, to fishery benefits than RD-1644 would have committed. The Fisheries Agreement allocates these fishery streamflows in a manner that enables YCWA to deliver approximately 350,000 acre-feet or more of water a year for consumptive use in Yuba County and to transfer water to downstream water users, including Delta-export agencies, for irrigation, municipal and environmental uses.

The Fisheries Agreement is only one of four agreements that make up the Yuba River Accord. The other agreements are: (1) a Conjunctive Use Agreement with local Yuba County water suppliers; (2) a Water Transfer Agreement with the state Department of Water Resources (DWR); and (3) an agreement with PG&E to allow modified operations at YCWA's New Bullards Bar Reservoir. Under the Conjunctive Use Agreement, Yuba County water suppliers agreed to pump up to 30,000 acre-feet of groundwater to substitute for surface water deliveries in certain dry years to provide water allocated by the Fisheries Agreement for fishery benefits. Also under the Conjunctive Use Agreement, YCWA agreed to provide funding from its Accord transfer proceeds to assist water suppliers in pumping the necessary groundwater and to monitor local groundwater conditions to ensure that pumping under the Accord does not cause overdraft. Under the Water Transfer Agreement, YCWA agreed to transfer at least 60,000 acre-feet per year of water to the Environmental Water Account (and successor programs) and potentially 140,000 acre-feet of water in drier years to DWR. In addition to assisting local Yuba County water suppliers in implementing conjunctive use, YCWA has used Accord transfer proceeds as contributions to setback-levee projects and other flood risk management projects.

The Accord Fisheries Agreement contains several unique elements in addition to the new streamflow requirements depicted in Exhibit A. That Agreement establishes a River Management Team (RMT), which includes representatives of YCWA, DFG, NMFS, USFWS, PG&E and conservation groups. The RMT has the ability to modify flows at certain times for fishery benefits. The RMT also is responsible for allocating 50% of the volume of any supplemental surface water transfer by YCWA and up to 20% of the streamflows enabled by implementation of the Accord Conjunctive Use Agreement. The RMT oversees a monitoring and evaluation program that is tasked with determining the efficacy of the Fisheries Agreement's streamflows. That Agreement also establishes a cap on irrigation diversions in extremely dry (1-in-100) "conference years" at about 70% of annual irrigation demands.

Consistent with the Accord agreements, the SWRCB's Corrected Order WR 2008-14 approved water-right permit terms under which, in conference years, YCWA would operate its project to maintain the minimum streamflows required by a 1965 streamflow agreement between YCWA and DFG, but without certain reductions authorized by that agreement and subject to supplemental flow release requirements developed by the RMT's Planning Group under the Fisheries Agreement and approved by the SWRCB's Deputy Director for Water Rights. Under Corrected Order WR 2008-14, if the Planning Group does not make any streamflow recommendations in a conference year by April 1 or if no streamflow requirements are in place by April 11 of such a year, then YCWA must comply with streamflow requirements ordered by the SWRCB after a hearing.

Finally, in operating its facilities, YCWA must comply with the requirements of its existing license no. 2246 from the Federal Energy Regulatory Commission (FERC). Those FERC license requirements, however, typically are dwarfed by the Accord Fisheries Agreement's streamflow requirements.

The Yuba River Accord has been recognized as a landmark achievement in collaborative water management to achieve water supply reliability and habitat protection. For example, the Accord received the 2008 ACWA Theodore Roosevelt Environmental Award for Excellence in Conservation and Natural Resources Management, the 2009 National Hydropower Association Award for Outstanding Stewards of America's Waters and the 2009 Governor's Environmental and Economic Leadership Award.

## Feather River

On December 15, 2010, the SWRCB adopted, as Order WQ 2010-0016, a water quality certification for the Oroville Facilities, FERC # 2100, for the relicensing of the Oroville project by DWR. The water quality certification contains instream-flow and temperature-control requirements for the Feather River's reaches downstream of DWR's Oroville Dam.

In general, the streamflow requirements adopted by the SWRCB in the certification are as follows.

For the Low Flow Channel – which is the reach between DWR's Fish Barrier Dam and the outlet of the Thermalito afterbay – the certification requires that DWR release into that Channel 800 cfs from September 9 to March 31 of each water year to accommodate spawning anadromous fish and 700 cfs the remainder of the time, with both standards subject to possible revision as recommended by resource agencies under a settlement agreement signed by parties to DWR's relicensing proceeding. The SWRCB's Deputy Director for Water Rights would have to approve changes from the indicated streamflows for the Low Flow Channel.

For the High Flow Channel – which is the reach between the Thermalito Afterbay's outlet and the Feather River's confluence with the Sacramento River – the certification applies the following instream-flow requirements, provided that they, along with project operations, are not projected to cause Oroville Reservoir to be drawn below elevation 733 feet (approximately 1,500,000 acre-feet of storage):

| Preceding April through July unimpaired runoff | Minimum Flow in HFC October-February | Minimum Flow in HFC March | Minimum Flow in HFC April-September |
|---|---|---|---|
| Percent of Normal | | | |
| 55% or greater | 1,700 cfs | 1,700 cfs | 1,000 cfs |
| Less than 55% | 1,200 cfs | 1,000 cfs | 1,000 cfs |

Under the certification, if applying these requirements would be projected to cause Oroville Reservoir to be drawn below elevation 733 feet, then the minimum streamflows in the High Flow Channel could be reduced by the same percentage as State Water Project deliveries for agricultural use, provided that streamflows would not ever be reduced more than 25 percent below the requirements. In addition, if the highest one-hour streamflow between October 15 and November 30 were to exceed 2,500 cfs because of project operations and not a flood flow, then DWR is required to maintain a minimum flow within 500 cfs of the peak flow.

The certification also contains complex terms that require DWR to operate the Oroville project to meet temperature standards in the Low Flow Channel and the High Flow Channel.

For the Low Flow Channel at the Robinson Riffle, the certification sets the following temperature standards: (1) October 1-April 30, 56 degrees F; (2) May 1-15, 56-63 degrees F (as a transition); (3) May 16-August 31, 63 degrees F; (4) September 1-8, 63-58 degrees F (as a transition); and (5) September 9-30, 58 degrees F. If DWR were to demonstrate that it cannot meet these requirements with its current facilities, then the certification would require DWR to submit an interim operations plan to the SWRCB and, within three years of the renewed FERC license's issuance, submit a long-term facility-modification and operations plan to the SWRCB. If after implementing the facility modifications, DWR were to demonstrate that it still cannot meet the above temperature standards, then DWR would be required to propose alternate temperature standards that would provide "reasonable protection of the COLD beneficial use." Upon the approval of the SWRCB's Deputy Director for Water Rights, DWR would be required to operate to the alternate standards.

For the High Flow Channel, DWR is required to operate the project "to protect the COLD beneficial use in [that Channel], as measured in the Feather River at the downstream Project Boundary, to the extent reasonably achieveable." Within one year of the renewed FERC license's issuance, DWR would be required to submit an operations plan for the period before facility modifications, which plan would be required to include proposed interim temperature standards and interim measures to reduce temperatures. Within three years of the renewed FERC license's issuance, DWR would be required to submit a long-term facility modification and operations plan, which plan would have to include proposed temperature standards to take effect within 10 years of the renewed license's issuance.

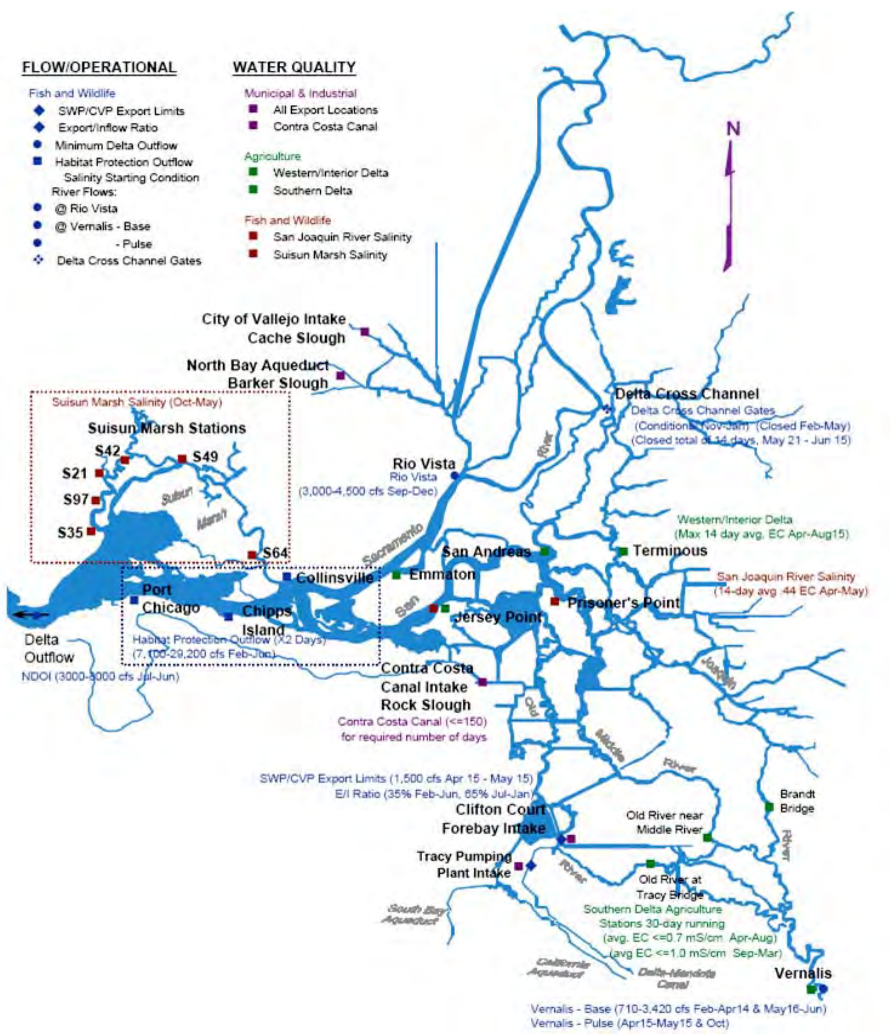
## Bay-Delta Standards

The following map shows the existing Bay-Delta standards in SWRCB Decision 1641. Water supplies in the Sacramento Valley are operated to meet these standards.

In 2002, the USBR, DWR, USFWS, DFG, various export water users, and various Sacramento Valley water users approved the Sacramento Valley Water Management Agreement (SVWMA), which established a framework to meet water supply, water quality, and environmental needs in the areas of origin, the Delta, and in export areas. The SVWMA provides that, pursuant to specified terms and conditions being met, certain upstream Sacramento Valley water users will take actions to make available up to 185,000 acre-feet of water that would otherwise not be available in the Sacramento River during the period June 1 through October 31 of each year.

Notably, the SWRCB facilitated the SVWMA parties' negotiation and execution of the SVWMA, by issuing its Orders WR 2001-05 and WR 2002-12, which stayed and ultimately dismissed Phase 8 of the Bay-Delta Water Rights Hearing related to SWRCB Decision 1641.

**D-1641 Bay-Delta Standards Stations**



# EXHIBIT A
## Yuba Accord Streamflows, Approved by SWRCB in Corrected Order WR 2008-14

| MARYSVILLE GAGE (CFS) | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Schedule | OCT | | NOV | DEC | JAN | FEB | MAR | APR | | MAY | | JUN | | JUL | AUG | SEP | Total Annual |
| | 1-15 | 16-31 | 1-30 | 1-31 | 1-31 | 1-29 | 1-31 | 1-15 | 16-30 | 1-15 | 16-31 | 1-15 | 16-30 | 1-31 | 1-31 | 1-30 | Volume (AF) |
| 1 | 500 | 500 | 500 | 500 | 500 | 500 | 700 | 1000 | 1000 | 2000 | 2000 | 1500 | 1500 | 700 | 600 | 500 | 574,200 |
| 2 | 500 | 500 | 500 | 500 | 500 | 500 | 700 | 700 | 800 | 1000 | 1000 | 800 | 500 | 500 | 500 | 500 | 429,066 |
| 3 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 700 | 700 | 900 | 900 | 500 | 500 | 500 | 500 | 500 | 398,722 |
| 4 | 400 | 400 | 500 | 500 | 500 | 500 | 500 | 600 | 900 | 900 | 600 | 400 | 400 | 400 | 400 | 400 | 361,944 |
| 5 | 400 | 400 | 500 | 500 | 500 | 500 | 500 | 500 | 600 | 600 | 400 | 400 | 400 | 400 | 400 | 400 | 334,818 |
| 6 | 350 | 350 | 350 | 350 | 350 | 350 | 350 | 350 | 500 | 500 | 400 | 300 | 150 | 150 | 150 | 350 | 232,155 |

* Indicated flows represent average volumes for the specified time period. Actual flows may vary from the indicated flows according to established criteria.
* Indicated Schedule 6 flows do not include an additional 30 TAF available from groundwater substitution to be allocated according to established criteria

| SMARTVILLE GAGE (CFS) | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Schedule | OCT | | NOV | DEC | JAN | FEB | MAR | APR | | MAY | | JUN | | JUL | AUG | SEP | Total Annual |
| | 1-15 | 16-31 | 1-30 | 1-31 | 1-31 | 1-29 | 1-31 | 1-15 | 16-30 | 1-15 | 16-31 | 1-15 | 16-30 | 1-31 | 1-31 | 1-30 | Volume (AF) |
| A | 700 | 700 | 700 | 700 | 700 | 700 | 700 | 700 | - | - | - | - | - | - | - | 700 | - |
| B | 600 | 600 | 600 | 550 | 550 | 550 | 550 | 600 | - | - | - | - | - | - | - | 500 | - |

* Schedule A used with Schedules 1, 2, 3 and 4 at Marysville.
* Schedule B used with Schedules 5 and 6 at Marysville.

# EXHIBIT 5

Water Resources • Flood Control • Water Rights

# M E M O R A N D U M

**DATE:** December 15, 2011

**TO:** Northern California Water Association

**FROM:** Walter Bourez

**SUBJECT:** Relating Delta Smelt Index to X2 Position, Delta Flows, and Water Use

**INTRODUCTION**

There has recently been much interest in requiring higher instream flows through the Sacramento-San Joaquin River Delta (Delta) in an attempt to reverse the continuing decline of a number of fish species that reside in or migrate through the Delta. Last year, for instance, reports issued by the State Water Resources Control Board (SWRCB) and the California Department of Fish & Game (DFG) stated that additional flows in the form of increased Delta outflows would be needed to meet the needs of both pelagic and salmonid species. More recently, the United States Environmental Protection Agency (USEPA) issued an Advance Notice of Proposed Rulemaking, which also suggested that higher instream flows through the Delta may be necessary. These reports rely on the theory that, by increasing instream flows and restoring a more natural hydrograph, habitat conditions for the fish species in question will improve and, as a result, fish populations will also improve.

Examination of the data used in each of these reports, however, shows that there is little, if any, scientific basis for the claim that additional flows will enhance declining fish populations. Key findings are:

1. The data used to support the claim that additional flows will enhance fish populations compares a wetter period (1956-1987) with a drier period (1988-2003). This invalid comparison of periods with very different hydrology is a fundamental flaw in the claim that increasing flows through the Delta will result in increasing fish populations.

2. Moreover, the constantly changing nature of the operations of the federal Central Valley Project (CVP) and the State Water Project (SWP) during the period from 1988-2003, as well as the fact that Delta outflow requirements increased during that period, make it difficult to conclude that a lack of flows is responsible for the decline in Delta fisheries.

3. A comparison of Delta fish population with water use in the Sacramento Valley shows that there appears to be no relationship between that water use and fish populations.

Taken together, all of these factors suggest that the decline in Delta fisheries is the result of factors other than flow.

Both the SWRCB and the DFG reports advocate modifying instream flows in the Delta and its tributaries so as to more closely mimic the natural hydrograph (i.e. streamflows occurring prior to 1850). A “natural hydrograph” means that hydrology will mimic the variability that occurred prior to the construction of the CVP and SWP. This variability included both wet and dry years. Examination of the data discussed above, however, indicates that both reports are – in fact – advocating not a natural hydrograph but, rather, that the Delta and its tributaries be operated so that every year mimics a wet or above normal year. If the fundamental concept behind the “natural hydrograph” claim is correct, then it is likely that it is just as harmful to fish species for every year to be a wet year as it would be if every year were a dry year.

Lastly, examination of the hydrologic data for the Delta leads to the strong conclusion that hydrology is not destiny. The continuing decline in fish populations, notwithstanding continuing regulatory adjustments to project operations through increasing Delta outflow requirements, strongly suggest that there are other factors at play. Specifically, as described in depth by Dave Vogel in his April 2011 report entitled *Insights into the Problems, Progress and Potential Solutions for Sacramento River Basin Native Anadromous Fish Restoration*, it appears that predation (particularly by non-native species) and habitat degradation in the Delta is likely a major problem for Sacramento River basin anadromous fisheries. In addition, there may be alternative ocean harvest methods that could increase the reproductive capacity of Sacramento River basin anadromous fisheries. The data presented in this report make it clear; however, that increasing Delta outflow by means of X2 is not likely to reverse population declines in anadromous fisheries.

## COMPARING HYDROLOGIC PERIODS DURING SPRING PERIODS

The SWRCB Delta Flow Report (at pages 104-106) compares average net Delta outflow for the January through June period from 1956-2009. The report then concludes that the “step-decline in the abundance X2 relationship that occurred after 1987 for many of these species . . . leads to uncertainty regarding the future response of these species to elevated flows.” (p. 107). Notwithstanding this caution, the report concludes that such elevated flows “are necessary to protect public trust resources and that the current flow regime has harmed native species and benefited non-native species.” (p. 108). Figure 1, below, contains “Figure 14, Net Delta Outflow Exceedance Plot – January through June” from page 106 of the SWRCB August 3, 2010 report titled: *Development of Flow Criteria for the Sacramento-San Joaquin Delta Ecosystem*, prepared pursuant to the Sacramento-San Joaquin Delta Reform Act of 2009. The line representing “Actual” flow for the 1956-1987 period is above the line representing the 1988-2009 period, indicating flow during the 1956-1987 period was greater. Average net Delta outflow during the 1988-2009 period was approximately 5,000 cfs less than during the 1956-87 period, which means that during the 1956-87 period there was approximately an additional 1.7 million acre-feet of net Delta outflow (5,000 cfs x 1.98 af/cfs x 180 days) than during the 1988-2009 period.

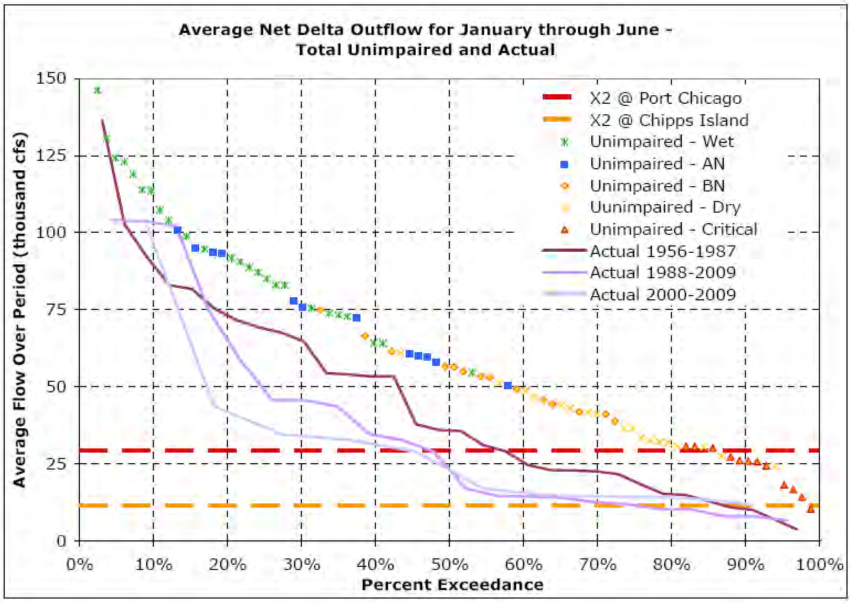



**Figure 1 - Net Delta Outflow Exceedance Plot from SWRCB Report Page 106**

Figure 2 shows probabilities of exceedance of historical ("actual") average Delta outflow for the DAYFLOW period of record (1930-2008) during January through June and the average Delta outflow for the periods 1930-1955, 1956-1987, 1988-2009, and 2000-2009. As in Figure 1, the 1988-2009 period is substantially drier than the 1956-1987 period.

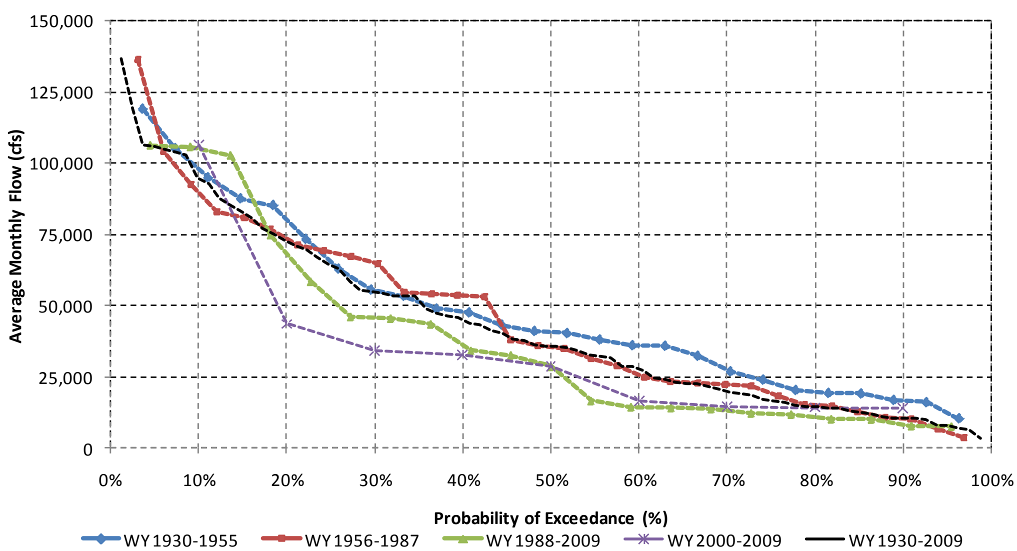



**Figure 2 – Average January - June Historical Net Delta Outflow from 1930 - 2009**

Figure 3 shows, for the January-June period, probabilities of exceedance of average unimpaired Delta outflow for the 1930-2003 period of record and the average unimpaired Delta outflow for those months during the component periods 1930-1955, 1956-1987 and 1988-2003. Unimpaired flow is runoff that would have occurred had water flow remained unaltered in rivers and streams instead of stored in reservoirs, imported, exported, or diverted. The data is a measure of the total water supply available for all uses after removing the impacts of most upstream alterations as they occurred over the years;

therefore, all variation in this data is due to natural causes. Although DWR has estimated unimpaired Delta outflow for the period of 1922-2003, this comparison uses the period after 1930 to be as consistent as possible with the DAYFLOW period.

Comparison of unimpaired flow for these various periods demonstrates variations due to hydrology alone, without human influence. Differences in the exceedance plots between the 1956-1987 and the 1988-2003 are solely due to natural variation in hydrology and cannot be attributed to project operations or water use.

As can be seen in the unimpaired flow chart in Figure 3, the 1956-1987 period was wetter than the average for the entire 1930-2003 period and was also generally wetter than the post-1988 period. On average, unimpaired Delta outflow during the January to June period during 1956-1987 seems generally to have been about 4,300 cfs greater than average January to June Delta Outflow during the period from 1988-2003. This means that, for the January-June period under unimpaired conditions, an average of about 1.5 million acre-feet more water would have flowed out of the Delta during the 1956-1987 period than during the 1988-2003 period. A flow difference of this magnitude can change X2 location and influence any conclusions based on this data. **Thus, the decline in the abundance-X2 relationship that occurred since 1987 is probably due, in significant part, to the fact that this period was substantially drier than the 1956-1987 period.**

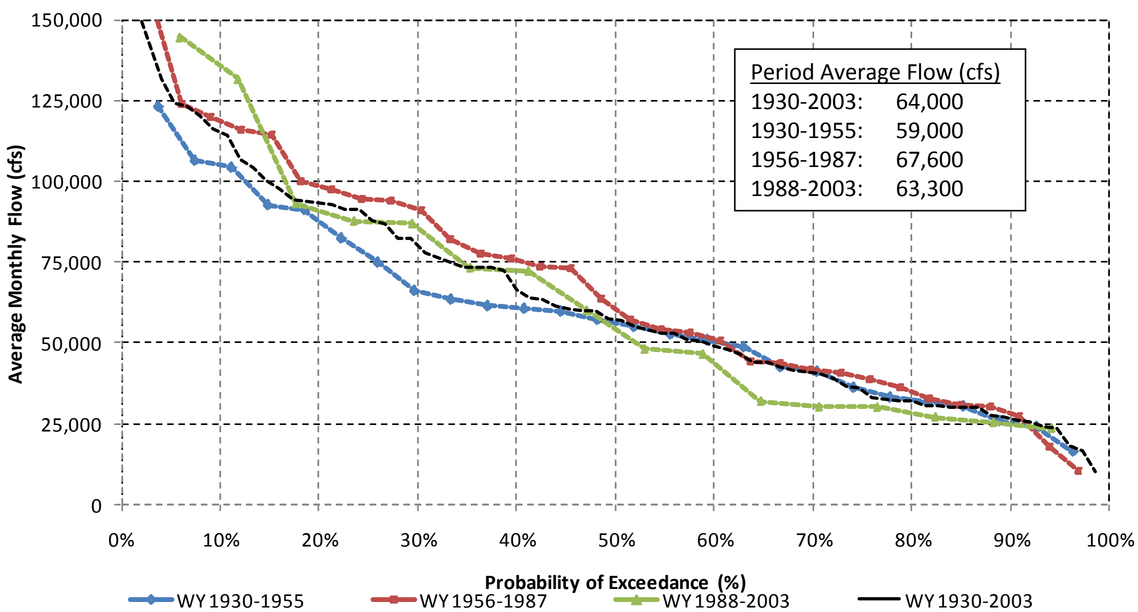



**Figure 3 – Average January – June Unimpaired Net Delta Outflow from 1930 - 2003**

## COMPARING HYDROLOGIC PERIODS DURING FALL PERIODS

In discussing the proposed fall X2 action, the SWRCB Delta Flow report states that "the average position of X2 during fall has moved upstream, resulting in a corresponding reduction in the amount and location of suitable abiotic habitat." (p. 108). The report then refers to a period since 1987 and particularly since 2000 during which the fall X2 has moved upstream. (p. 109). The report continues by using data from 1960-2010 (report Figure 15) and data from 1956-2008 (report Figures 16-18). (pp. 110-112).

Again, these data seem largely to reflect the contrast between a relatively wet period from 1956-1987 and the relatively drier period since 1988. Figures 4, 5, and 6, below, compare average unimpaired Delta outflow for September, October and November, respectively. In each of those months, the period from 1956-1987 was substantially wetter than the long-term average (1930-2003) and very much wetter than the period from 1988 to 2003. Again, unimpaired flow is used for this comparison to demonstrate the differences due to hydrology alone, without human influence.

The purpose of these charts is to illustrate the importance of using representative periods when comparing fish abundance. Only if two periods being compared have the same hydrology can one attribute the increase or decline in abundance to factors other than hydrology (e.g., changes in exports, introduced species, etc.).

From a policy perspective, these data cast significant doubt on the efficacy of a proposed fall X2 action. Implementation of the fall X2 action is based on the concept that there have been man-made changes in project operations (perhaps to increase exports) since 1987 and that part of the suite of actions needed to restore Delta fisheries is the reversal of those changes. However, if the upstream movement of X2 during the fall since 1987 is largely a reflection of drier hydrology during the post-1987 period and if the goal of Delta restoration efforts is to replicate "natural" conditions to the extent feasible, then "fixing" natural hydrology may be a well-intentioned, but counter-productive, action that diverts attention from the actual causes of declining Delta smelt populations, such as invasive species or other ecosystem stressors of the type identified in the Vogel report referred to earlier. Attempting to impose historical wet-year hydrology on the Delta and its tributaries in all years also could severely reduce the amount of cold water available to support the needs of salmon and steelhead in Delta tributaries at important times of the year.

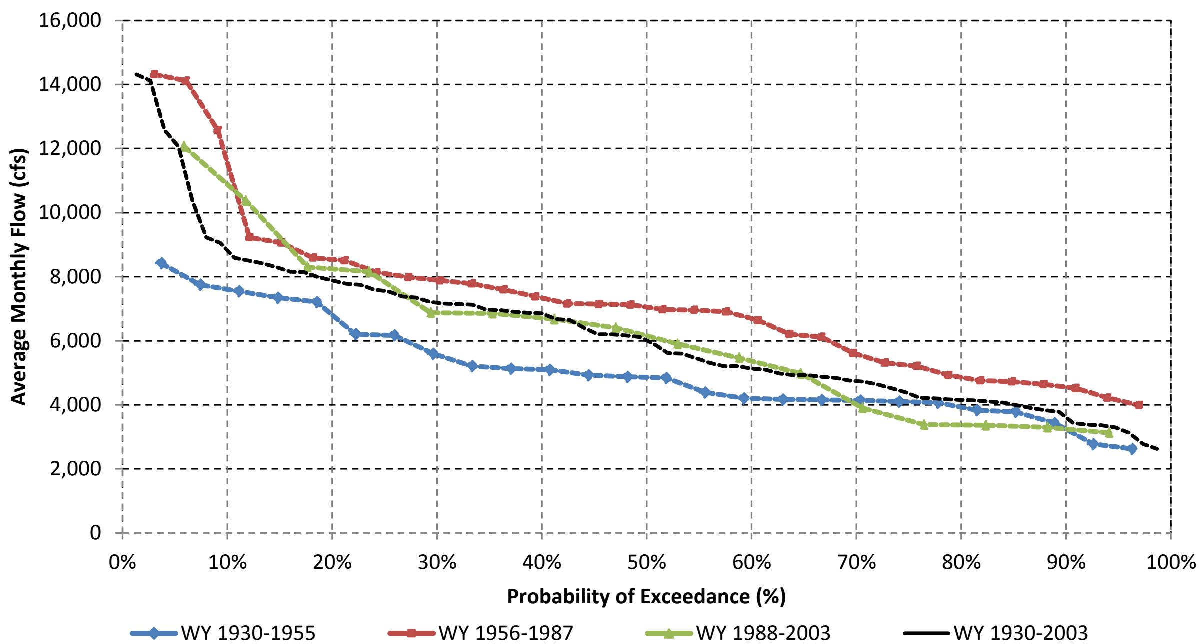



**Figure 4 - Average <u>September</u> Unimpaired Net Delta Outflow from 1930 – 2003**

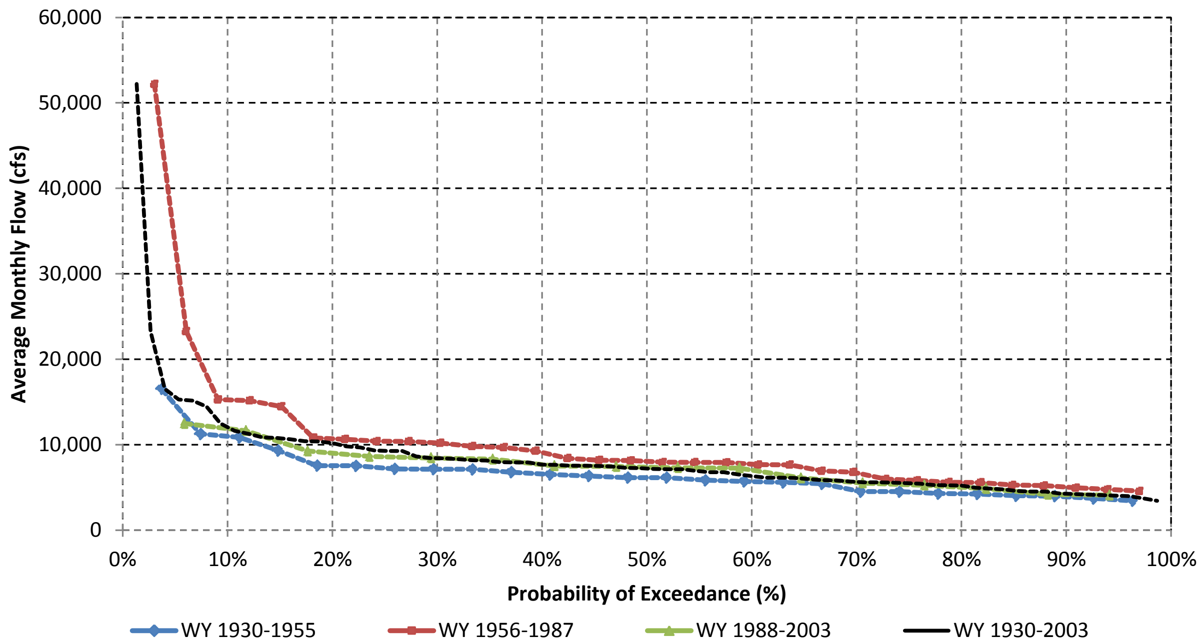



**Figure 5 - Average October Unimpaired Net Delta Outflow from 1930 - 2003**

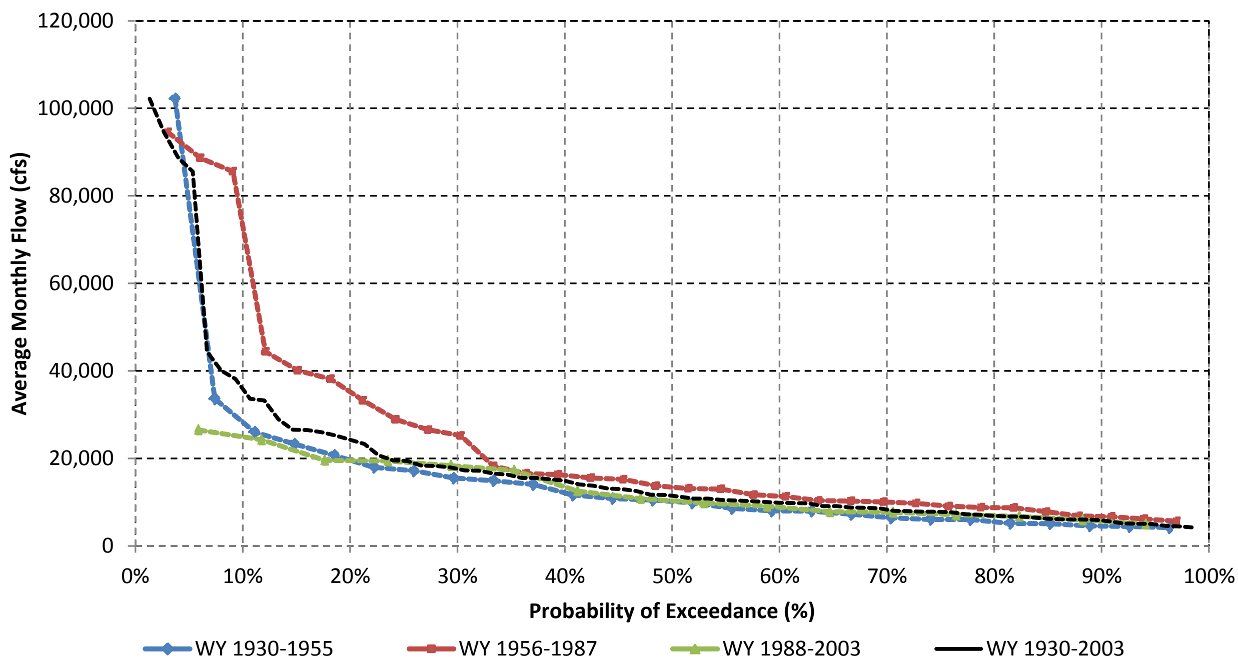



**Figure 6 - Average November Unimpaired Net Delta Outflow from 1930 - 2003**

The USEPA's Advanced Notice of Proposed Rulemaking ("ANPR") concludes that the "low salinity zone in the fall has moved upstream, especially after 2000." (p. 53). This statement is almost identical to the statement in the SWRCB's 2010 Delta Flow Report and is subject to the same criticism: it compares a wetter period (1956-1987) with a drier period (1988-2008) and attempts to draw conclusions regarding the status of delta smelt without acknowledging that the species is likely to do more poorly in a drier period.  Similarly, the ANPR states there has been a "dramatic decline in the variability of the location (and therefore the extent) of low salinity habitat." (p. 53).   The ANPR also states "In the late 1990's, the median areal extent of this low salinity estuarine habitat was about 9000 hectares in the fall; since 2000, that habitat declined by about 78 percent."(p.52).  This statement compares a few very wet years in the late 1990's to a drier period that contains a mix of year types, including several very dry years, to conclude there has been a 78 percent decrease in habitat.  The decline is in part due to hydrology, but may also be due to changes in regulatory standards.  The increased Delta outflow requirements in the spring contained in SWRCB D-1641 have mandated increased reservoir releases during the spring months and lower upstream reservoir storage during the summer and fall period.  This reduction in upstream reservoir storage has resulted in decreased reservoir releases during fall months, which in turn has resulted in X2 moving upstream in the fall.  **In other words, the ANPR is correct to note that the location of X2 during the fall has moved upstream since the year 2000; the ANPR, however, fails to understand and acknowledge that the cause of that upstream movement is the requirement for increased spring Delta outflow contained in D 1641 as well as dry conditions throughout California. The lesson here is that it is important to recognize that measures to benefit one life stage or one species can have unintended effects on other life stages or other species.**

Figure 7, below, contains the average X2 location during the months of September, October, and November for the period of 1930 – 2008.  The average X2 location presented in the ANPR's Figure E on page 54 displays X2 locations for the period from 1967 – 2008.  Figure E implicitly uses the late 1960's and early 1970's as the baseline against which to evaluate subsequent changes in X2 locations, and concludes that X2 has moved substantially upstream over time.  However, as can been seen in Figure 7, analyzing X2 position for the entire period of record (1930-2008) leads to a different a conclusion.  The periods before and after the 1967-1975 period are drier, therefore this period should not be used as a baseline from which to draw conclusions.  The entire period of record should be used to better understand how the system has changed.  In the earlier period from 1930 to the early 1940's, before the Projects began operation, X2 position during the fall was farther upstream.  When the Projects began operation, releases were made to satisfy instream flow requirements and Delta requirements causing Fall X2 to move downstream.    The "natural" position for X2 during fall months is farther upstream than has occurred since the Projects began operations and releasing water to comply with environmental flow requirements.   Because the delta smelt index is not available prior to 1967 it is not possible to determine if there is a relationship between fall X2 and the delta smelt index.

The consequence of these errors is that many of the effects that both the SWRCB's 2010 Delta Flow report and the USEPA's Advanced Notice of Proposed Rulemaking have attributed to reduced Delta outflows are, to a substantial extent, actually reflections of the variations in the natural hydrology of the Delta watershed since the late 1980's.  It is not clear what is actually causing that change in hydrology or whether it will continue.  What is clear is that the pre-1987/post-1987 comparison that has been used to justify both proposals for increased Delta outflows during the springtime and the proposed fall X2 action is a comparison between a relatively wet period and a relatively dry period.

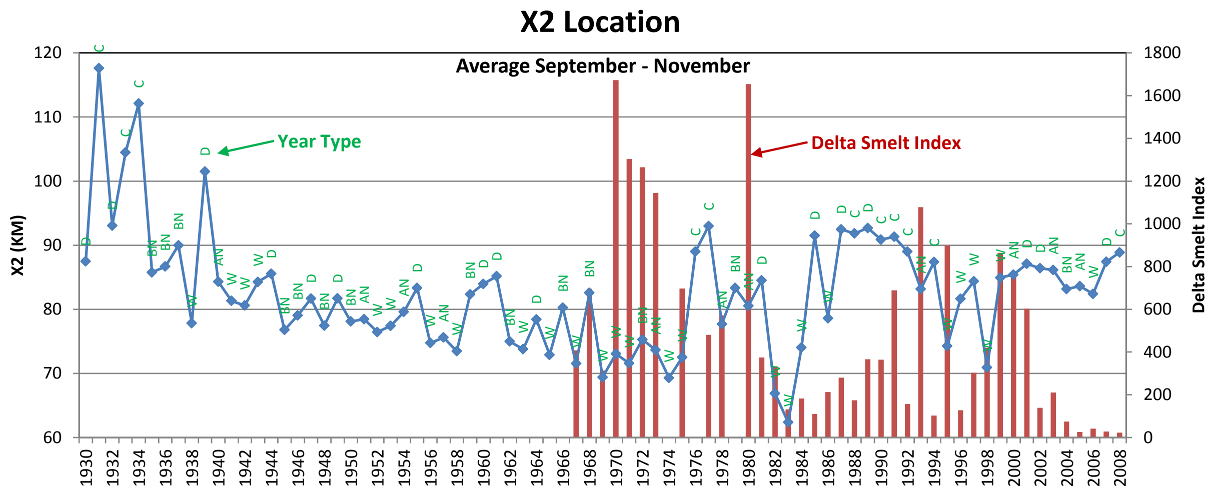



**Figure 7 – Average September Through November X2 Location and Delta Smelt Index**

## CHANGES IN SACRAMENTO BASIN FLOWS AND DIVERSIONS DURING THIS PERIOD

Figure 8 shows Sacramento Valley irrigated acreage and combined annual diversions of water by the eight largest Sacramento River Settlement Contractors (SRSCs) for the period 1964 to 2008. Together, these eight diversions comprise about 90 percent of total settlement contract diversions in the Sacramento River Basin. These data indicate, that despite hydrologic variability, irrigated acreage has not increased and diversions by the SRSCs, while fairly consistent from year to year, have declined slightly over the past twenty to thirty years. This decline is probably due to changes in cropping mix, increased irrigation efficiency, and cultural practices.

Figure 9 contains a chart of historical diversions and consumptive use produced by the state's 2007-2008 Delta Vision Task Force. The data on the bottom of the bar chart is labeled "Estimated Sacramento Valley agricultural consumptive use of applied water + urban demand." This chart shows that upstream water use has been fairly constant over the past 40+ years.

Figure 10 shows the historical Delta smelt index from 1967 to present, Sacramento Valley irrigated area, and annual diversions by the Sacramento River Settlement Contractors. During the period between 1967 and 1980, the Delta smelt index varied significantly. During the 1980's, the Delta smelt index was largely stable, but relatively low. During the 1990's, the Delta smelt index was quite variable, but with little relation to hydrology. Since 2002, the Delta smelt index has been very low. This variability presents a clear contrast with Sacramento Valley irrigated area and diversions by the Sacramento River Settlement Contractors, which – as noted above – have been fairly consistent over the 40+ year period.

In summary, the available data indicate that the populations of the fish species that have been the focus of Delta restoration and recovery efforts for the past fifty years have been quite variable. There may be some relationship for some species to hydrology (e.g., the very low levels of Delta smelt during the 1976-77 drought) but those relationships are, at best, unclear. What is clear is that there does not appear to be a relationship between populations of Delta smelt and Sacramento Valley irrigated area or diversions by the Sacramento River Settlement Contractors, which were quite consistent over that period.

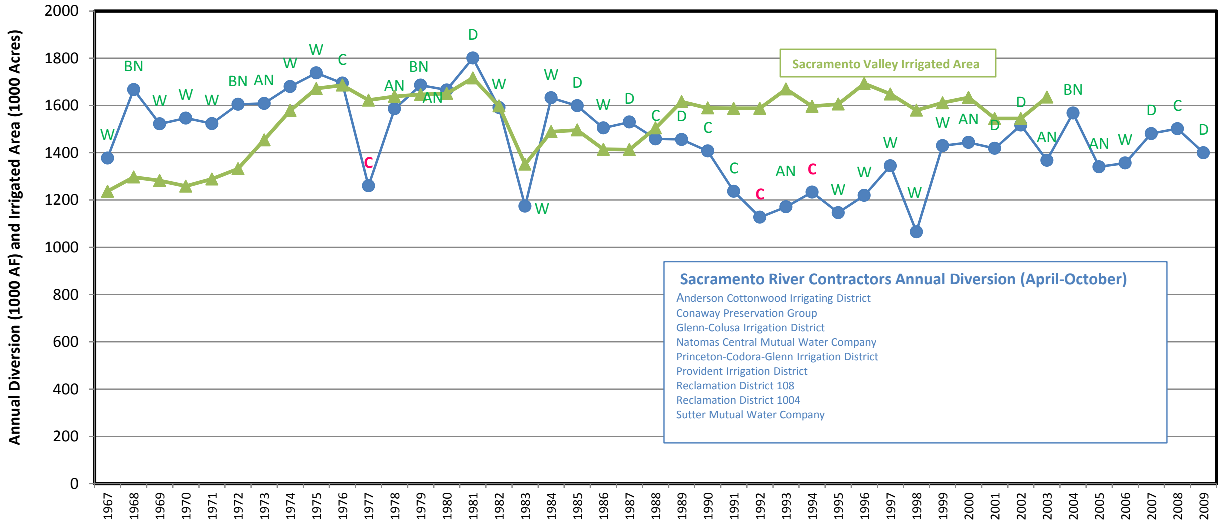



**Figure 8 – Sacramento Valley Irrigated Area and Annual CVP Settlement Contract Diversions**

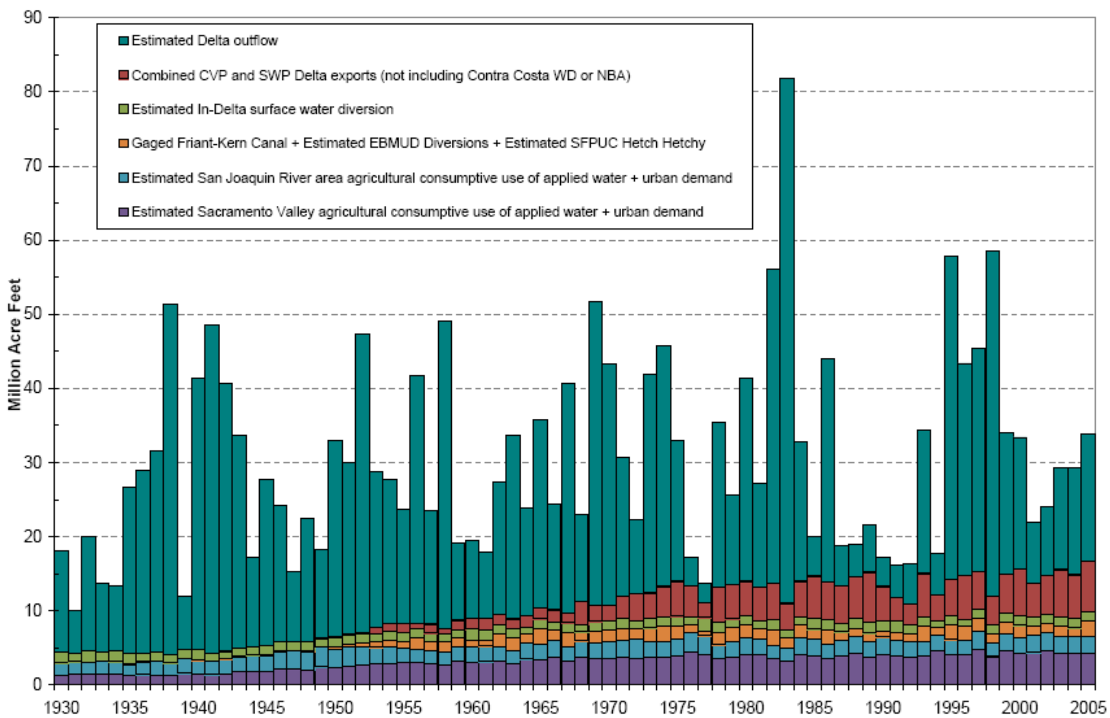



**Figure 9 –Delta Vision "Revised Figure 7b – Historic Diversion from the Delta"**

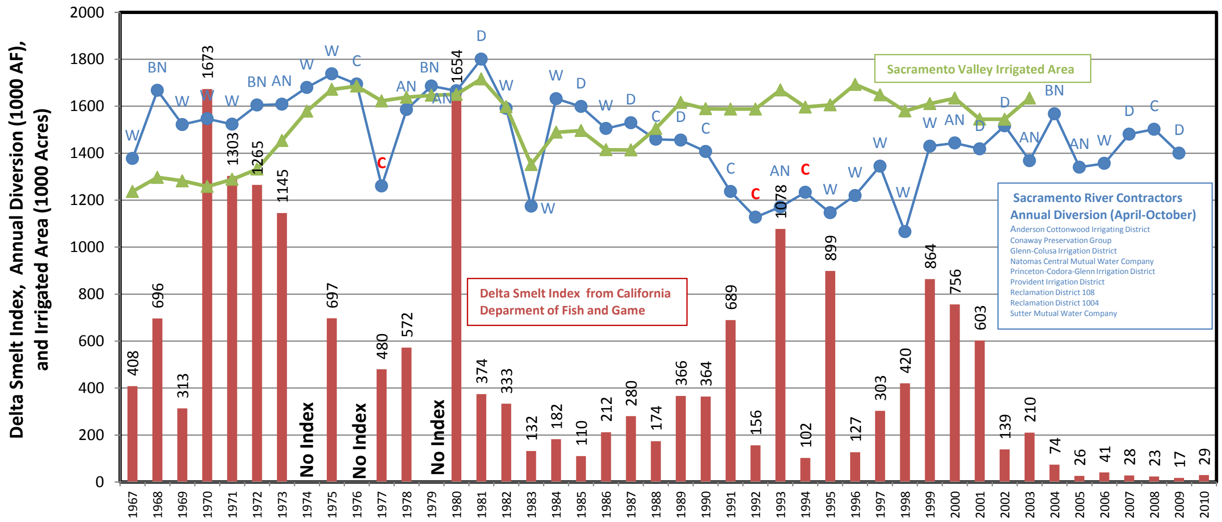



**Figure 10 – Sacramento Valley Irrigated Area, Annual CVP Settlement Contract Diversions, and Delta Smelt Index**